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THESIS

**THE FUTURE FACES OF THE CUBAN ECONOMY:
A BAYESIAN FORECAST**

by

Barton J. Bernales

September 1995

Thesis Advisor:

Robert E. Looney

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**THE FUTURE FACES OF THE CUBAN ECONOMY:
A BAYESIAN FORECAST**

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ABSTRACT

This thesis investigates the applicability and results of a Bayesian approach used to forecast the future direction of the Cuban economy. The Castro regime, bound to a stagnant political ideology, has limited the options by which to save socialism and the revolution. This study first examines the historical, political and economic contexts that define the decision environment and then proceeds to formalize hypotheses, target variables and relevant events indicative of Cuba's economic direction. The qualification of the Cuban economy as either a centrally planned economy, a mixed economy or a predominantly market economy leads to forecast scenarios that create a framework upon which to apply Bayesian techniques. The results of the Bayesian forecast and sensitivity analysis support three major conclusions: 1) Bayesian analysis is an adroit methodology by which to explicitly determine the probabilities of Cuba's economic direction; 2) Cuba's economic direction, given recent efforts and initiatives, favors either a mixed or market economy; and 3) in contrast to the resurrection of the institutions of the Cuban revolution, the advancement of Cuba's economic recovery will warrant a predominantly market economy.

TABLE OF CONTENTS

I. INTRODUCTION	1
A. PURPOSE AND OBJECTIVES	1
B. ORGANIZATION AND APPROACH.....	3
II. BACKGROUND.....	8
A. HISTORICAL CONTEXT	8
1. Cuban-Soviet Relations: 1960-1990	9
2. Economic Reform Measures: 1975-1990	11
a. The Free Farmers' Market.....	12
b. The Rectification Process	14
c. The Special Period in Peacetime.....	15
B. THE NATURE OF THE CUBAN ECONOMY	17
1. Socialism and Centrally Planned Economies.....	18
a. Cuba Compared to the China Experience	20
b. Market Socialism and Mixed Economies.....	22
2. Present Concerns.....	24
a. Cuba's Economic Challenges	25
b. Limiting Factors	29

III. CONSIDERATIONS IN FORECAST SPECIFICATION.....	31
A. THE POLITICAL ENVIRONMENT.....	31
1. The Leadership of Fidel Castro	32
2. Civil and Military Opposition.....	34
a. Civil Discontent	35
b. Revolutionary Armed Forces (FAR).....	36
B. THE ECONOMIC AREAS OF FOCUS.....	37
1. The Sugar Industry.....	39
a. Production Output and World Market Absorption....	41
b. By-product Diversification.....	42
2. The Tourism Industry.....	43
3. Non-sugar Agriculture Sector	46
a. Rice	46
b. Vegetables.....	47
c. Citrus	47
d. Tobacco.....	49
4. Energy	50
a. Oil production/Oil exploration.....	51
b. Nuclear Power	53
5. Nickel	55
6. Biotechnology	56
7. Foreign Direct Investment.....	57
8. The Black Market	59
9. The Dollarization of the Cuban Economy.....	61
10. Cuba's Foreign Debt	63
11. External Policies of Regional/International Actors.....	63

IV. SPECIFICATIONS OF THE FORECAST.....	66
A. STATES OF NATURE.....	66
B. TARGET VARIABLES.....	67
1. Event 1--Foreign Exchange Earnings Exceed \$4 bn....	68
2. Event 2--Import Substitution Meets 50% of Consumption.....	68
3. Event 3--Political Control is Maintained by Castro.....	69
4. Event 4--Economic Reforms Result in Less Centralization.....	69
5. Event 5--Integration into Global Financial Community.....	70
6. Event 6--Foreign Trade/Aid Policies Benefit Cuba.....	70
C. SCENARIO FORECASTS	71
1. Scenario I: Events Occur 1-2-3-4.....	72
2. Scenario II: Events Occur 4-3-2-1	73
3. Scenario III: Events Occur 3-4-2-1.....	74
4. Scenario IV: Events Occur 2-3-4-1	76
5. Scenario V: Equiprobable Hypotheses	77
6. Scenario VI: A Road to Recovery.....	79
7. Scenario VII: An Economic Lifeline	80
D. SENSITIVITY ANALYSIS.....	82
1. The Foreign Exchange Earning Under a CPE.....	83
2. Political Control and a CPE.....	85
3. The Foreign Exchange Earnings Under a Market Economy	87
4. Pessimistic and Optimistic Probability Judgments	89

V. FORECAST RESULTS AND CONCLUSIONS	92
A. FORECAST RESULTS.....	92
B. CUBA'S ECONOMIC DIRECTION.....	95
C. CUBA'S ECONOMIC RECOVERY	95
D. THE APPLICABILITY OF BAYESIAN FORECASTING	97
APPENDIX A: AN INTRODUCTION TO BAYES' THEOREM.....	99
APPENDIX B: AN EXAMPLE OF HIERARCHICAL INFERENCE	101
LIST OF REFERENCES	105
INITIAL DISTRIBUTION LIST	115

I. INTRODUCTION

A. PURPOSE AND OBJECTIVES

The economic reforms currently taking place in Cuba merit close examination as the future of the Cuban economy may very well shape its political future. The collapse of the former Soviet Union has devastated the Cuban economy and has forced Fidel Castro to seek alternative means by which to save socialism and the revolution. Castro has vowed never to embrace capitalism, yet he realizes the need to move away from a centrally planned economy. Unlike the leaders of the former Soviet Union and Eastern Europe, who are experiencing dissimilar economic motivations, Castro remains vehemently opposed to making a complete transition to a market economy. Thus far the Castro regime has chosen to implement both economic and political reforms incrementally, largely in response to worsening conditions. Externally, Cuba continues to court foreign investment with limited success. Many Cuban analysts believe these efforts are inadequate because they prolong popular suffering and serve only to temporarily delay economic collapse. There is a strong consensus that unless the Castro regime proceeds along the most direct path to a market economy, the Cuban economy is doomed to meander aimlessly.

The economic crisis in Cuba is deepening and has already begun deteriorating the social gains of the revolution. The Cuban economy faces a precarious paradox. Fidel Castro can no longer depend on Soviet subsidy and must now seek immediate means to generate hard currency, however, the options available to Cuba are limited by a stagnant political ideology. The

current economic priorities of the Castro regime became apparent after the meeting of the Fourth Congress of the Cuban Communist Party, held in October 1991; they serve to define the desired terminal state of the Cuban economy for this study. The priorities are:

1. to earn hard currency via joint ventures and exports
2. to achieve foodstuff self-sufficiency
3. to pursue alternative sources of energy
4. to maintain political control of the economy, and
5. to ensure Cuba's survival despite the U.S. embargo.

Each of these initiatives is a response to Cuba's economic isolation, and the future direction of the Cuban economy will internally depend upon their attainment. Even though the abandonment of socialist economic ideals seems inevitable, there exists a critical period of transition for Cuba. It is during this period that Castro's decisions and their impact upon selected target variables can be assessed and the associated probabilities of economic direction charted.

The future direction of the Cuban economy and the extent of its recovery may be gleaned by employing the fundamental ideas of decision theory combined with Bayesian analytical methods. The purpose of this thesis is to examine the potential for using a Bayesian approach in making a forecast of the direction of the Cuban economy in the short (1-2 years) to medium (3-5 years) term. Much of the recent literature dedicated to Cuba's "life after the Soviet Union" addresses strategies of economic reform and reconstruction or presents political and economic scenarios possible in the near term, whereupon possible future scenarios implicitly imply the direction of the Cuban economy. The purpose of this study will be to explicitly determine the probabilities of Cuba sustaining a centrally planned

economy or transitioning to a mixed or predominantly market economy based upon the conditional dependence of specific variables: foreign exchange earnings, import substitution, political control, economic reforms, integration into the international finance community, and the policies of international or regional actors. Armed with such probabilistic outcomes, a forecast of Cuba's economic direction can be proposed given an observed sequence of events.

The results of this study will avoid political and ideological judgment of Fidel Castro's reforms and the debate over the U.S. trade embargo. Although this may be the likeliest of times for the Castro regime to come to an end, the relevance of this study may transcend into the longer term if the view expressed by the distinguished Cuban expert Jorge Dominguez is correct:

In the long run, the free market transition will lay the foundation of Cuba's future, no matter who rules the nation or what form the government takes [Ref. 1: p. 101].

B. ORGANIZATION AND APPROACH

According to Adolf Lowe, the aim of a socialist economy in transition is a terminal state (of nature) with an efficient use of resources and a higher rate of growth, and not necessarily the marketization and privatization of the economy. The challenge in analyzing the transformation of centrally planned economies via this approach is to establish the ends-means relationship accurately. The terminal state is defined in terms of specified macroeconomic goals and institutional changes instrumental to their achievement. What remains to be determined is whether the envisioned institutional structure creates the necessary motivations to move the economy to the desired terminal state [Ref. 2: p. 61].

Following this introduction, Chapter 2 provides both the historical context and current appraisal of the Cuban economy from which the underlying assumptions governing the analytical framework of the study are drawn. Examined are the political and economic impact of past economic reforms, the nature of the Cuban economy taken against the socialist backdrop of centrally planned economies and the economic challenges ahead. Chapter 3 discusses the political considerations used to define the decision making environment, as well as the major economic sectors within the Cuban economy and the significance of these sectors with respect to Cuba achieving the terminal state desired by Fidel Castro. The integration of the previous three chapters sets the initial conditions, target variables and formalizes the forecast mechanics that are presented in Chapter 4. Finally, conclusions drawn from the forecasts and their implications regarding economic direction and recovery are presented in Chapter 5. Contained within Appendices A and B are a brief introduction to Bayes' theorem and a numerical example using hierarchical inference to calculate the assigned probabilities of relevant events.

An econometric approach, although feasible, may prove too complex and cumbersome in assessing a generalized sense of economic heading; considering the difficulty of establishing, mathematically, production functions without reliable data and the crisis mode in which the Cuban economy is currently operating. A time-series model, which extrapolates past economic trends into the future, usually occurs in cases where a large number of data points are available [Ref. 3: pp. xii-xv]. In the case of Cuba, this approach encounters three major obstacles. First, the data points must be accurately translated from their original socialist accounting context (the Material Product System, systemic to the countries of the former Soviet

trade bloc) where price setting is fundamentally different from that in market economies. Second, historic macroeconomic data is either unavailable or significantly skewed by the magnitude of past Soviet subsidy so as to decrease the confidence level collectively assigned to the data points. Third, economic trends exhibited by a Soviet-dependent Cuba cannot be unconditionally extrapolated and applied to a post-cold war Cuba where the Soviet Union no longer exists.

A single-equation regression model attempts to explain the variable under study by a single, often time-dependent, function (linear or non-linear) of explanatory variables [Ref. 3: p. xiv]. The previous work of Alonso and Lago provide such an "approximation" model assuming a post-Castro democratic Cuba.¹ Similarly, a multi-equation simulation model seeks to relate the explanatory variables, through a set of equations, not only to the variable under study, but to each other as well. Both of these approaches requires a thorough understanding of the economic interrelationships and processes being studied, and consequently, the construction of such models may prove extremely difficult [Ref. 3: pp. xiv-xv]. The dynamics of the Cuban economic crisis force a collateral reevaluation of the processes at work and thereby compound the necessary mathematical formulations. Pursuant to the obstacles expressed thus far, a Bayesian forecast appears to be an applicable, appealing alternative; even though no similar application of the methodology was discovered upon reviewing the literature.

Bayes' theorem provides a formal procedure for revising the probability assessments of hypotheses concerning a situation such that evidence upon which the revisions are based is (1) more systematically

¹ See José F. Alonso and Armando M. Lago, "A First Approximation Model of the Balance of Payments, Output, Employment and Foreign Aid Requirements of a Democratic Cuba (Washington, D.C. : ASCE, 1993).

considered than it would be intuitively and (2) is given more weight than if it were intuitively aggregated and judged. Thus more information can be extracted from the available data because the technique allows each piece of evidence, whether central or marginal, to add its weight to the final assessment in a systematic way. [Ref. 4: p. xiv] In some cases the observed data cannot be directly related to a given hypothesis, but instead is interrelated with an intermediate variable within a hierarchical structure. Hierarchical inference serves to decompose a complex relationship by using such a hierarchical structure. It may be easier to first assess those probabilities linking the data to the intermediate variables (events or evidence indicative of events) relevant to the hypothesis and then assess the probabilities linking the intermediate variables to the hypothesis. [Ref. 5: p. 117] Bayesian analysis calls for all probability assessments to be subjective and therefore risks reflection of undue bias or genuine disagreement among analysts. Bayesian techniques seek to overcome these shortfalls by assigning a formal role to subjective (non-data) information, allowing the forecaster to evaluate the impact of such information on the conclusions via a sensitivity analysis.

Theorizing that the Cuban economy can be qualified as either a centrally planned economy, a mixed economy or a predominantly market economy, specifies a set of mutually exclusive and collectively exhaustive possible outcomes that constitute the hypothesis under analysis. Following the tenets of decision theory and Bayesian analysis the following approach results: (1) each of the possible outcomes is subjectively assigned a probability of occurrence; (2) considered next are events and/or evidence that would support the aforementioned outcomes; (3) the indicators related to these events and/or evidence are identified; (4) quantitative linkages

(conditional probabilities) are established between adjacent levels based upon existing knowledge or information and hierarchical inference, as dictated by the fundamental principles of decision theory; (5) lastly, as new events occur or evidence is received, the use of Bayes' theorem leads to the revision of the original probabilities assigned. [Ref. 4]

As a result of the Bayesian forecast, a graphical representation of the initial and revised probabilities of the hypotheses will be used to illustrate the overall trends of the Cuban economy as relevant events occur. In addition, a sensitivity analysis of the forecast will be performed by substituting high and low values into various probability assessments and recalculating the hypotheses' outcome probabilities, thereby providing a range and an idea of the relative sensitivities involved [Ref. 5: pp. 100-101]. The originally assigned probabilities can also be adjusted in response to changing political or economic events and the forecast revised to reflect other probabilistic scenarios. Expanding or refining the possible outcomes or variables under consideration will warrant further study.

II. BACKGROUND

A. HISTORICAL CONTEXT

Over the past three decades, Cuba has experienced a geopolitical demise moving from being a world actor in Africa and the Middle East; to a regional actor in El Salvador and Nicaragua; to ultimately becoming a small state struggling to survive economically [Ref. 6: p. 22]. Upon reviewing the recent history of the Cuban economy, two periods are essential in tracing the events leading up to the current Cuban economic crisis--Cuban-Soviet economic relations since 1960 and the three major economic reforms undertaken by the Castro regime beginning in 1980. A positive constant in Cuban development strategies has been the emphasis on social concerns of the revolution such as full employment, equitable distribution and access to health and education services. Performance in the economic goals of growth diversification, and external economic independence have been less satisfactory [Ref. 7: pp. 38, 41]. A turbulent environment for change has resulted from Castro's strong desire to preserve Cuban socialism and the increasing economic pressures to establish the conditions for production within the Cuban economy.

The Cuban economy examined within its historical context provides valuable insight into the motivations of Fidel Castro and his economic policies. The magnitude and extent of past Soviet assistance represents the subsidy required to perpetuate the Cuban economy.

Consequently, the termination of Soviet aid has exposed critical sectors of the Cuban economy that demand new development strategies. The results of past economic reforms reveal an assessment of success and failure by the Castro regime, which may similarly influence future economic decisions.

1. Cuban-Soviet Relations: 1960-1990

Since the early 1960s the central reality of the Cuban economy has been its dependence upon Soviet aid, which became the island's economic lifeline. For over thirty years, Soviet economic assistance also allowed Fidel Castro to pursue and subsequently fund the social aims of the revolution, thereby representing an ideological partnership as well. Soviet economic assistance to Cuba, which totaled between \$3.7-\$4.8 billion dollars per year,² came in direct balance of payments and project aid as well as in price subsidies for Cuba's imports and exports.

Beginning in the 1980's, Cuba increased its foreign exchange by importing substantial volumes of sugar from the world market at depressed world market prices in hard currency for re-export to the Soviet Union at preferential prices in soft currency. Cuba used the soft currency revenue to buy Soviet oil that was then re-exported to western Europe for dollars [Ref. 8: p. 120]. These deals resulted in substantial hard currency gains for Cuba. Soviet oil and sugar subsidies were close to 20 percent of the Cuban GDP during several years of rapid growth in the early eighties [Ref. 8, 6]. Economic pressures

² According to Soviet Politburo member, Yuri Maslyukov, the differences arise from the use of different exchange rates to convert rubles to dollars.

within the Soviet economy soon forced domestic priorities to supersede Cuba's subsidy. Cuba saw the last year of full Soviet economic support in 1989.

On December 31, 1990, the Soviets began to cut their aid programs and negotiated a new bilateral economic framework, whose terms formally ended the Soviet subsidy of the Cuban economy. The agreement stipulated the following:

1. a sharp cut in the Soviet annual deliveries of petroleum and petroleum products to Cuba
2. clearing commodity exchanges at world market prices
3. reduction of the timespan governing the economic agreement from five years to one year, mainly due to the uncertain economic situation of the Soviet Union, and
4. sharp reductions in military aid, including the withdrawal of technicians and advisors.³

Since 1991, most of Cuba's trade relations are governed by current world prices and hard currency transactions. Through December 1991, imports from the Soviet Union amounted to 1,673 million pesos, 70 percent lower than imports received in 1989. The future configuration of economic relations with the former Soviet republics (particularly Russia) will be determined by the extent to which their respective economies have recovered or transitioned, and the world market price for oil versus Cuban sugar and nickel [Ref. 10: p. 99], [Ref. 11: p. 125].

³ President Mikhail Gorbachev announced the withdrawal of Soviet troops from Cuba on September 12, 1991, and by June 1993 the last contingent of Russian troops, numbering 300 men, had left Cuba .

The Cuban economy, formally dependent on the Soviet Bloc for 85 per cent of its trade and investment, has shrunk by an estimated 50 per cent since the disintegration of the Soviet Union. The Real GDP growth rate has declined steadily from 0.1 percent in 1989 to -25.0 percent in 1991.⁴ Cuba's imports from the former Soviet Union fell 70 percent, from \$5.522 billion in 1989⁵ to \$1.673 billion in 1991.⁶ Despite the end of the Cuban-Soviet economic relationship, markets still exist in both countries for exports by the other. Soviet-manufactured machinery in Cuba remains in desperate need of spare parts and there remains within the CIS a market for sugar estimated at 2 million metric tons.⁷ Two large voids resulted from the end of preferential Cuban-Soviet economic relations, implicit subsidization and badly needed imports.

2. Past Economic Reform Measures: 1975-1990

In 1975, the Cuban government began to increase their efforts to institutionalize both central planning and popular participation under the System of Management and Planning of the Economy [Sistema de Dirección y Plantificación de la Economía] (SDPE). The system included limited administrative autonomy for state farms, as well as broad structures for material incentives and popular participation. The institutionalization of planning and participation

⁴ EIU World Outlook 1994 (London: Economist Intelligence Unit, 1994), 194.

⁵ Carmelo Mesa-Lago, "The Economic Effects on Cuba of the Downfall of Socialism in the USSR and Eastern Europe," chap. in CUBA After the Cold War (Pittsburgh: University of Pittsburgh, 1993), 171.

⁶ Edward Gonzalez and David Ronfeldt, Cuba Adrift in a Postcommunist World (Santa Monica: RAND, 1992), 4.

⁷ *Ibid*, 32.

was expected to strengthen the planners' ability to direct resource flows to support political priorities. It was expected to promote economic efficiency and permit more local input into economic decisions. [Ref. 12: p. 232] The SDPE characterizes Cuba's first attempt to implement central planning with stable institutions and defined functions [Ref. 13: p. 126].

The SDPE failed to cause significant decentralization, and prompted the Cuban government to introduce two subsequent reforms aimed to improve upon its functioning: the free farmers' markets of the early 1980s, and the rectification process initiated in 1986. The collapse of trade relations between Cuba and the Soviet Bloc spawned another major economic reform: the special period in peacetime, announced in 1990. The current economic crisis in Cuba embodies the relative success and failure of these reforms, which represent both problem and solution.

a. The Free Farmers' Market

The free farmers' market, initiated in 1980, was intended to correct technical problems of the SDPE, such as poorly defined material incentives, irrational prices and insufficient enterprise autonomy [Ref. 12: p. 238]. The market allowed private farmers to domestically sell output produced above the state quota at free market prices. The free farmers' market generated an increase in private sector output, but also produced side effects contrary to Cuba's goals of socialist development [Ref. 14: p. 831]. Despite its success, the free farmers' market began to be severely curtailed by 1982 and was stopped in 1986, even though it had succeeded in providing

consumers with an increased availability of foodstuffs [Ref. 15: p. 10]. By restricting private trade, the government could better control what private farmers produced, and minimize the diversion of goods from the export to domestic market. The government also tried to take advantage of the closure by raising some parallel market retail prices. This strategy failed to generate the expected increased revenues, as in 1988 parallel market sales rose by 13 million pesos, but total sales declined by 70 million pesos, as farmers lost their material incentive to maximize output. [Ref. 16: p. 78]

The introduction of the free farmers' market soon became incongruous, creating high-income earning possibilities for individual farmers, and reducing the incentives for collectivization . The inability of the cooperatives to compete with individual farmers in terms of potential income levels was linked to their inability to sell in the lucrative private market.⁸ Cooperatives were also under pressure to produce certain products which were socially desired, but unprofitable at state prices. [Ref. 14: pp. 834, 836]

The Cuban experiment with free market mechanisms increased income inequality, stimulated the emergence of speculators, and diverted resources, including those intended for sugar cane, to the more profitable free markets. For Cuba, the free farmers' market logically represents an essential part of any program striving to attain food self-sufficiency. Alonso points out that given the price incentives of a free market, production could respond in a short period of time,

⁸ At the height of their participation in the free farmers' market, the cooperatives accounted for less than 10 percent of the volume of sales. Carmen Deere and Mieke Meurs, "Markets, Markets Everywhere? Understanding the Cuban Anomaly," World Development 20, no. 6 (1992): 833.

usually a crop cycle.⁹ Contrary to this Fidel Castro has expressed his aversion to private farms, stating, "Group private property is not and will never be socialism. It will simply be group capitalism." [Ref. 17: p. 94] Castro remains keenly aware that extending popular participation implies greatly reducing the power of party officials over the establishment of social priorities [Ref. 12: p. 238].

b. The Rectification Process

The free farmers' markets of the 1980s were believed to have been a mistake in that they generated inequalities. In April 1986, Fidel Castro called for the "rectification of errors and negative tendencies," a decision to place more emphasis on political consciousness and moral incentives. The major elements of the rectification process include:

1. reversal of economic decentralization measures and recentralization of major decisions,
2. the abolition of the free farmers' market,
3. elimination or restriction of private manufacturing, service, and housing construction activities,
4. reintroduction of construction "minibrigades" and the creation of construction contingents (production units assigned to an area),
5. reduction of redundant workers, tightening of labor norms and wages, and emphasis on moral incentives,

⁹ José F. Alonso, "The Free Farmers Market: A Rejected Approach But A Possible Solution," in Cuba in Transition Volume 2 Second Annual Meeting in Miami, Florida, August 13-15, 1992, by The Association for the Study of the Cuban Economy (Latin American and Caribbean Center: Florida International University, 1993), 179.

6. attempts at macroeconomic stabilization, particularly the trade and budget deficit, and
7. vigorous efforts to root out economic crime and corruption.¹⁰

According to Eckstein, the policies associated with the rectification campaign reveal a state attempting to address its fiscal needs, even at the expense of the class in whose interests it claims to rule. The rectification process suggested a renewed commitment by the Castro regime to socialist values and socialist organizing principles [Ref. 16: p. 83]. In 1990 Mesa-Lago provided a statistical summary of the rectification process:

...in three or four years of the Rectification there has been: a 3.2% decline in per capita economic growth, a 7.4% decline in labor productivity, a 78% increase in the hard currency debt, a 79% jump in the trade deficit with the USSR, no significant improvement in the hard currency trade balance and a 682% increase in the budget deficit [Ref. 17: p. 103].

The rectification process reversed the expansion of the private sector through the elimination of incipient market mechanisms. It also served to restore power to Castro and his paternalistic economic policies, causing further deterioration of the Cuban economy.

c. The Special Period in Peacetime

In August 1990, Fidel Castro announced the beginning of a "special period in the time of peace" acknowledging the erosion of Cuba's international economic environment. Castro spoke of Cuba

¹⁰ Jorge F. Pérez-López, "The Cuban Economy: rectification in a changing world," Cambridge Journal of Economics 16 (March 1992): 115.

facing the "zero option" caused by a "double embargo"; the dearth of Soviet Bloc imports and the unyielding U.S. trade policy. The austerity program is a combination of limited economic reform and drastic subsistence policy, the main objectives of the special period are to:

1. reduce the consumption of oil and consumer goods through universal rationing,
2. increase the production of staple foods through the colonization of new land and shifting surplus labor to the countryside,
3. pursue foreign investment through joint ventures and production sharing arrangements, which promote hard currency earnings, and
4. facilitate the reinsertion into the world markets by undertaking management and selective structural reforms.¹¹

In summary, what had begun in 1975 as a campaign to institutionalize central planning and popular participation evolved into a desperate struggle for economic survival. The special period is characterized by scarcity and sacrifice, and represents Castro's indefinite strategy for dealing with the current crisis. It also has perpetuated black market activity and may result in increased civil opposition. Ultimately, what these past reform measures serve to reflect are latitude and ideological rigidity of the policies acceptable to Fidel Castro, and the balance struck between economic recovery (survival) and socialist preservation.

¹¹ Andrew Zimbalist, "Teetering on the Brink: Cuba's Current Economic and Political Crisis," Journal of Latin American Studies 24 (May 1992): 411.

B. THE NATURE OF THE CUBAN ECONOMY

In the post-1990 period the Cuban economy is described by Gonzalez as a bifurcation, where socialism governs the internal economy and sugar sector while a new external sector is being created on the basis of joint enterprises with foreign investors in petroleum, tourism, biotechnology and other selected areas [Ref. 15: p. vi]. The nature of the economy, however, remains trade dependent, monocultural and subject to external shocks due to its unbalanced production matrix [Ref. 18: p. 17]. The Cuban budget draws upon revenues which originate from three sources: the state sector, the non-state sector (the private sector plus cooperatives) and the population at large. In FY 1990 the state sector contributed 97.8 percent of state budget revenues, the non-state sector, 0.6 percent and the population, 1.6 percent. [Ref. 19: p. 26].

The Cuban economy is moving away from a centrally planned economy to establish the conditions for promoting efficient production and increasing hard currency earnings. The possible scenarios which may govern this transition include:

1. Castro could remain in power implementing his present policies (even at the expense of increased repression),
2. Castro could alter his economic course in a more liberal direction to defuse escalating discontent (shifting to a Chinese-type model),
3. an overthrow of Castro by pragmatic elements in the Cuban government could retain a socialist orientation but incorporate market mechanisms, or

4. most unlikely, an invading force could overthrow Castro.¹²

A process of transition is a process of managing uncertainty and, in the case of Cuba, the last few years have been a period of increasing uncertainty [Ref. 20: p. 6]. The future direction of the Cuban economy is dependent upon the extent to which socialism and the mechanisms of a centrally planned economy are suitable to meeting the economic challenges ahead.

1. Socialism and Centrally Planned Economies

The two traditional strengths of a centrally planned economy (CPE) are its ability to distribute scarce resources equitably and to mobilize resources in support of priority projects. The former has prevented mass unemployment and generalized malnutrition in Cuba: the latter has enabled Cuba to develop sources for earning hard currency. Together they form the backbone of the Castro regime's strategy to cope with its economic crisis. [Ref. 21: p. 411]

The state sector within Cuba is by far the largest contributor to state revenues. Consequently, the economic returns of state endeavors and state-owned enterprises are vital elements within any CPE implementing a plan for growth or recovery. The dependence is described by Oleinik:

To be able to perform its economic functions successfully, in accordance with national economic plans, the State must have at its disposal sufficient monetary resources and concentrate in its hands a considerable share of national income. [Ref. 19: p. 2]

¹² Gillian Gunn, "Will Castro Fall?," Foreign Policy 79 (Summer 1990):144.

State-owned enterprises have to contend with multiple objectives that often conflict with profit maximization, and may require explicit government subsidies or implicit subsidies such as guaranteed sales to the government at fixed prices [Ref. 22: p. 14]. Higher prices would eliminate the need for state subsidies to producers, and would allow a cut in the state budget. Cognizant of such distortions, a session of the Cuban National Assembly held during early-May 1994, reported that only 31 percent of the state companies are profitable and that subsidies to loss-making state enterprises would be cut [Ref. 23: pp. 4-5].

Within CPEs, prices--including the exchange rate--are set administratively and do not reflect relative scarcities or the costs of producing goods and services. Fixed wholesale prices facilitate plan construction and monitoring of plan implementation, while fixed consumer prices avoid open inflation. Centrally determined prices reflect planners' preferences rather than those of consumers, and do not provide incentives for firms to produce goods other than those required by the state. [Ref. 7: pp. 20-21]

The institutional framework of CPEs may also negatively affect foreign trade. State monopoly of foreign trade insulates domestic producers and consumers from foreign markets. Insulation from competitive forces in the world market means that domestic producers need only meet low domestic standards for quality, reliability, and innovation. This insulation is partly responsible for the difficulties faced by CPEs in selling manufactured products in the world market. The emphasis on quantity targets, and on managerial

rewards based on fulfillment of quantitative targets, leads to a lack of attention to quality and limits the ability of CPEs to compete in those markets where quality is an important factor. [Ref. 8: pp. 84-85]

a. Cuba Compared to the China Experience

Fidel Castro recently responded, "It is an experiment that must be studied," when asked if China was an example to follow.¹³ One distinctive feature of the Chinese economic transition which distinguishes it from Cuba is that China started from a more balanced macroeconomic position, applied generally conservative macroeconomic policies, and was not subject to large external shocks during reform [Ref. 24: p. 127]. A large country that was not dependent on the Soviet Union, China was not affected to a great extent by the political transition that took place. The costs of remaining in power of its ruling group were not sharply increased, and it could continue to move toward a market economy without greater fear of losing political control than before the Soviet collapse. [Ref. 25: p. 246] A gradual transition strategy requires effective state management; how to frame this role constructively becomes increasingly more difficult when the state loses the capacity to enforce its policies.¹⁴ The political stability maintained in China has been an important factor encouraging the investment and growth needed to effect monumental changes smoothly. [Ref. 24: p. 128]

¹³ "Exclusive" interview with Fidel Castro by *La Stampa* reporter Jas Gawronski; place and date not given, FBIS-LAT-94-003-A, 5 January 1994.

¹⁴ Eastern Europe and Russia, with some exceptions, have completely new political systems with little capacity to implement government economic functions, including such basic functions as the ability to collect taxes. Dwight H. Perkins, "Comment" on the work of Alan Gelb, Gary Jefferson, and Inderjit Singh, "Can Communist Economies Transform Incrementally? The Experience of China," *NBER Macroeconomic Annual 1993*, (Cambridge: MIT Press, 1994), 133.

Some of the lessons learned from China are contradictory to Cuban economic reforms initiated since the early 1980s; such as those that advocate the fundamental creation of private agriculture and economic incentives designed to tempt large numbers of people into becoming entrepreneurs [Ref. 26: p. 324]. The most significant conclusion that Castro may have derived from the Chinese experience is that political economy, rather than simply economic theories, lies at the heart of the process of socialist transition. According to Gelb, Jefferson and Singh, it is most unlikely that China-style reform would be acceptable or successful with a sharp transition away from communist government. The basic outline of economic reform in China seems to be irreversible, but there is still a possibility that a chaotic political transition could damage macroeconomic stability and stall reform movement [Ref. 24: pp. 127-29].

Fidel Castro also became a quick study of the attempted reforms that eventually undermined other communist regimes, and adheres to the following:

1. undertake as few political reforms as possible,
2. get rid of deadwood in the party early on,
3. deal harshly with potential or evident disloyalty, and
4. do not allow formal opposition to organize.¹⁵

The Castro regime has thus far considered these tenets an integral part of any strategy effecting economic recovery or transition.

Two additional lessons of the China experience are given by Sachs,¹⁶ both of which Cuba has recently experienced first-hand.

¹⁵ Jorge I. Dominguez, "The Secrets of Castro's Staying Power," Foreign Affairs (Spring 1993), 99.

First: "Small business development can proceed rapidly, even in a poor country and after decades of repression." The September 1993 decree legalizing 117 enterprises for self employment soon resulted in uncontrollable chaos and was subsequently amended in early March 1994. Government officials were concerned that many "entrepreneurs" were not paying taxes; stealing their merchandise from the state; or charging steep dollar prices. Second: "Macroeconomic destabilization can provoke social unrest with harsh consequences, as occurred in China in 1989." On August 5, 1994, a riot involving approximately 20,000 people erupted in Havana. The melee, spurred by a rumor of a ferry bound for Florida and dire economic conditions, left two police officers killed and thirty-five people injured.

b. Market Socialism and Mixed Economies

In a broad sense, a socialist market economy is one in which there is decentralized decision-making and socialized ownership. Despite its collectivization efforts and long-standing resistance to the use of markets, since the 1970s the Cuban government has increasingly recognized the limitations of central planning as a means of producing and distributing all but the most essential consumer goods [Ref. 14: p. 826]. A social market would permit the continuation of social achievements and would also stimulate the efficiency advantages made possible by the orchestration of economic activity by the market mechanism [Ref. 27: p. 29]. Market

¹⁶ Jeffrey D. Sachs, "Comment" on the work of Alan Gelb, Gary Jefferson, and Inderjit Singh, "Can Communist Economies Transform Incrementally? The Experience of China," *NBER Macroeconomic Annual 1993*, (Cambridge: MIT Press, 1994), 143.

socialism represents an alternative to the Castro regime, which over the long term wants to ensure that the establishment of market mechanisms do not undermine the society's socialist ethos or threaten existing authority [Ref. 28: p. 62].

There are potential difficulties in utilizing market mechanisms to perfect central planning. First, the benefits of resource allocation within markets are highly dependent on markets taking a specific form. Markets must function as an interrelated, competitive systems in which prices of inputs and outputs are mutually responsive, and can successfully transfer information conveying both scarcity and consumer demand in related markets. Secondly, market mechanisms consistently generate tensions within the institutional architecture of a central plan, as entrepreneurs compete with the state for valuable resources. [Ref. 14: p. 827] In addition, entrepreneurial opportunities may cause excessive migration or absenteeism of the work force, adversely affecting state production. The sustainability of a market socialist economy is assessed by Antonio as, "neither structurally nor functionally operable. It would be a living contradiction in continual conflict with itself." [Ref. 29: p. 7]

Baloyra contends that current Cuban policy calls for a mixed economy, combining foreign capitalist enclaves, primarily in the export and tourism sector, with socialist production and distribution predominantly in the domestic sector [Ref. 20: p. 14]. This model blends the free market with a planned economy, mixes private and public ownership, and balances a concern for efficiency against equity. However, it places less emphasis on the market,

private-sector ownership, and efficiency in favor of distributional equity and public-sector involvement in the economy. [Ref. 27: p. 25]

A mixed economy may result in a dichotomy as glaring inequities are excused as necessary incentives to attract elusive foreign capital. Cuba's attempt to create enclaves of foreign investors sends profits abroad while it imposes upon workers the high cost of state production for the domestic market. Prices are used to redistribute income rather than allocate resources, creating bottlenecks in the supply of many goods. Firms with export potential are likely to be pressured to buy inputs from inefficient state-owned monopolistic suppliers when cheaper inputs are available from abroad. Cardoso and Helwege warn that Castro's joint ventures in tourism and exports do not ensure efficiency and competitiveness. As the principal investor in these joint ventures, the Cuban government may end up absorbing heavy losses. [Ref. 30: pp. 55-57]

2. Present Concerns

Ritter argues that the root cause of Cuba's economic contraction from 1986 to 1990 was ultimately the decline in the real value of the implicit subsidization from the USSR and the convertible-currency debt crisis, which stifled imported industrial inputs and retarded growth [Ref. 31: p. 118]. The cessation of Cuban-Soviet trade relations has since led to major declines in the availability of foreign exchange, in the capacity to import, in levels of economic activity and investment, and in real living standards [Ref. 27: p. 4]. The accelerated structural deterioration of the Cuban economy is of major concern; it forms the basis of increased frustration and growing

popular discontent. Currently, the majority of Cuban trade is restricted to hard currency transactions and thereby obligates Cuba to reduce its external dependence, and develop a virtually self-financed growth strategy [Ref. 31: p. 119].

The two factors that determine the outcome of reforms, according to Cardoso and Helwege, are the political legitimacy of the transition, and economic policies [Ref. 30: p. 82]. Cuban economist Tejada concedes that economic reforms conducive to a mixed socialist economy are inevitable, but warns they will invariably introduce market forces that could result in major deformations spoiling the very transformation achieved by the revolution. He specifies that private enterprise would alleviate some of the burden of the State to subsidize unemployment but it also produces an income differential. [Ref. 32: pp. 87, 84] Monreal and Rúa del Llano, of the Center of American Studies in Cuba, claim that the opening of the Cuban economy has demonstrated, if only partially, that the transition from one economic structure to another is possible while preserving the social bases of political power [Ref. 33: p. 50]. The present concerns of the Castro regime are to meet urgent economic challenges with viable reforms that produce tangible results, despite their being taxed by limiting factors.

a. Cuba's Economic Challenges

The challenge for Cuba in the immediate term is to achieve economic reorientation while maintaining the basic equity of income distribution and its success in fulfilling basic human needs [Ref. 31: p. 144]. The inability of the Cuban government to guarantee a

respectable level of popular consumption and maintain basic nutrition could become a flash point for political upheaval against the Castro regime. Alonso and Rathbone see Cuba's survival dilemma resulting from the fact that:

Economic returns...are not re-invested to create tomorrow's opportunities for Cubans; they are used to fund today's survival...success (of Castro's reforms) merely means that the strategy continues [Ref. 34: pp. 123, 125].

The low level of domestic consumption is probably manageable as long as the political cohesion of the government and the security forces prevails. Up to now popular discontent has been diffused by an unopposed mass exodus of Cubans from the island. Through September 1, 1994, 22,484 Cuban boatpeople were rescued by the U.S. Coast Guard and Navy, the largest one-year exodus since the Mariel boatlift of 1980. On September 9, 1994, after eight days of negotiation, the Castro regime pledged to stop its citizens from fleeing Cuba for Florida aboard makeshift rafts and small boats. In return, Washington promised to accept at least 20,000 new Cuban immigrants each year.

Cuban economists agree that there exists the need for changes and readjustments that serve to preserve the historic objectives of the Revolution: national independence, social equality, popular democracy and economic development. As such, they see two fundamental objectives to any current economic strategy: to maintain the benefits guaranteed by the Revolution and to reinsert Cuba into the world economy. [Ref. 35: p. 1] The economic challenges confronting

Cuba, although simply stated, involve complex interrelations between the internal and external sectors of the economy.

Current challenges to the internal sector of the Cuban economy include:

1. promoting productive employment to reduce low economic efficiency;
2. expanding agricultural output to achieve food sufficiency;
3. maintaining the quality of social services degraded by resource limitations imposed by the special period;
4. pursuing alternative sources of energy;
5. controlling financial imbalances and inflationary pressures; and
6. minimizing the impact of infrastructure deterioration.

According to Cuban economist, Carranza Valdez, a fundamental principle of the economic system should be a strong relation between a worker's wages and their output thereby linking individual and national entrepreneurial interests. However, this is to occur during a difficult time, when there are contradictory movements between the necessary centralization of scarce resource management caused by the crisis and the decentralization necessary to change the existing system. [Ref. 36: p. 30]

The interdependence between the internal and external sectors, regarding their role in meeting these economic challenges, is summarized by Cuban economist Luis Rodriguez, as:

...the ability to address domestic problems is predicated on solving the very difficult current international situation. In fact, it is evident that the resource limitations imposed by the Special Period cannot be eased and the external financial balance and economic efficiency will not improve in any meaningful way unless foreign trade and financing flows improve. [Ref. 37: p. 39]

Current challenges to the external sector of the Cuban economy include:

1. overcoming the effects of changes in economic relations with Eastern Europe and the former Soviet Union;
2. increasing foreign exchange earnings through the diversification of exports;
3. integrating into global markets; and
4. attracting foreign investment.

Carranza Valdez explains that through the expansion of non-traditional exports and import substitution Cuba can reduce external dependence through internal integration that essentially includes foodstuff self-sufficiency. Non-traditional exports must increase so that Cuba can continue to import despite the absence of international credit. For the next few years the Cuban economy will be forced to function at an import level below its needs. [Ref. 36: pp. 15, 21] Antonio adds that the transforming effort must focus on those conglomerates or blocks of economic sectors, which because of their importance in the nation's economy and their systemic relations with other sectors and activities, promise to contribute the most toward growth and recovery [Ref. 29: p. 27].

The reintegration of Cuba into the capitalist global market may also take place through trade-partner diversification which

requires a search for new exports and other sources of revenue and foreign capital. The principal obstacle to Cuban trade has been the lack of sellable exports and the excessive concentration on sugar exports, now aggravated by the disappearance of socialist trade partners and subsidies. [Ref. 38: p. 208] Foreign exchange earnings for 1995 are estimated to be between \$2.3-\$2.9 billion, compared to \$5.8 billion in 1989, and represent no significant change from 1992 [Ref. 39: p. xiv].

b. Limiting Factors

The Cuban economic structure was not designed to compete in the world market but to operate within another institutional framework: that of the Council of Mutual Economic Assistance (CEMA). CEMA was an international governmental organization incorporating many countries from the former Soviet Bloc whose aim was to promote the "socialist economic integration" of its members. Cuba joined CEMA in 1972, which was originally set up at a conference in Moscow in early January 1949 and formally dissolved June 28, 1991. [Ref. 40: pp. xi, xxxi] Until the 1990s, 80 percent of Cuban export sales were guaranteed by CEMA so there was no incentive to diversify and improve quality [Ref. 38: p. 212]. Carranza Valdez claims the loss resulting from the break in relations between Cuba and the socialist camp was not only favorable commercial ties but a strong economic integration [Ref. 36: p. 6]. The disappearance of Cuba's traditional trade partners has left the Cuban economy isolated and in possession of a dysfunctional institutional structure. These conditions are exacerbated by current account and trade deficits, and

the inability to service its foreign debt; all which severely limit Cuba's access to capital investments, advanced technology and international markets.

The political rigidity and lack of experience with market mechanisms of the Castro regime have impaired its ability to fulfill what Aguila calls, "its responsibilities as the guardian of revolutionary morality" [Ref. 41: p. 73]. Ritter asserts that over time, the current system (centrally planned and demarketized) has blocked the economic improvement and diversification necessary to maintain and enhance social welfare gains [Ref. 27: p. 16]. Within a centrally planned economy, corruption and persistent shortages are likely to proliferate without a flexible supply of inputs [Ref. 14: p. 837]. Such economic inefficiency promotes civil opposition and unrest, increasing political risk that may dissuade potential investors; it also prevents the internal economy from benefiting from such things as foreign investment [Ref. 36: p. 27].

III. CONSIDERATIONS FOR FORECAST SPECIFICATIONS

Presented in this chapter are the political environment within which Cuba's economic decisions are most likely to be influenced, and the areas of the Cuban economy upon which those decisions will most likely be focused. The purpose of such dissection is to define the framework used to develop the forecast scenarios presented in Chapter 4. Examined here are the dominant political and economic sectors that affect Cuba's attempt at achieving the terminal state desired by Fidel Castro.

A. THE POLITICAL ENVIRONMENT

Cuba is faced with unfavorable external conditions not of its own making. It also confronts detrimental internal conditions that are of its own making. This combination is likely to produce an untenable situation with potential for turmoil and probable change [Ref. 42: p. 21]. The political environment under which such turmoil and change exists in Cuba is defined by Fidel Castro's commitment to Cuban socialism despite civil discontent over decreasing levels of domestic consumption and social benefits. Influential to the short-term economic decisions undertaken by the Castro regime will be the perceived intensity, extent and duration of popular opposition, and the regime's ability to suppress or appease. For the purpose of this study the political longevity of Fidel Castro and his policies are assumed to prevail into the near term. In addition, estimates concerning

dollarization of the Cuban economy and inflation on the black market will serve as a crude barometer of civil discontent.

1. The Leadership of Fidel Castro

The Cuban context within which decisions are made to deal with the economic crisis will first and foremost succumb to the paternalistic rule of Fidel Castro and his dominance not only within the political strata but his stature as an icon of Cuban nationalism. Castro equated his version of socialism with Cuban nationalism in a December 1989 speech:

In Cuba, revolution, socialism, and national independence are insolubly linked....If capitalism returned someday to Cuba, our independence and sovereignty would disappear forever. We would be an extension of Miami. [Ref. 43: p. 140]

The current economic policies of Fidel Castro demonstrate a reluctance to stray from centralization and his intentions of cautiously guarding political control. According to Jaime Suchlicki, Director of the North-South Center at the University of Miami, "economic considerations have never dominated Castro's policies" [Ref. 44: p. 105]. Similarly, Baloyra describes Cuba's "re-equilibration as an attempt by the historic leaders to subordinate the scope and nature of change to their own political survival" [Ref. 20: p. 9].

Castro's most recent reforms have been aimed at increasing foreign exchange in the hands of the government, rather than privatizing enterprises and freeing prices [Ref. 45: p. 32]. Fidel Castro and his economic vision for transition have so far been derived from his proclamation that, "We must base ourselves on our experience, our

own ideas, our own interpretations of Marxism-Leninism.” and is prophetically reflected in the comments made by Lenin in 1921:

We should not give in to romantic socialism...that feels an unconscionable disdain for commerce. All economic forms are admissible during transition...[and] necessary...to reactivate the economy...forms of commerce that are used in the capitalist countries...can foster an improvement of commercial activity under socialism once they are drained of their capitalist content. [Ref. 46: pp. 119, 107]

The probability of Cuban policy makers committing serious errors is high since macroeconomic policy expertise or experience within Cuba is extremely limited. Consequently, a misguided policy could have disastrous results that would be difficult to remedy or reverse in the short or medium term. Humberto Leon of the Cuban Information Service at the North-South Center, University of Miami, characterizes Fidel Castro as not willing to accept nor understand that the economy will not recover unless the domestic population is allowed to participate via market reforms which in turn will generate growth [Ref. 47]. Leon summarizes the critical centrality of Fidel Castro by stating:¹⁷

The power of Fidel Castro is based on the control that Fidel Castro has over the problem and the dependence of the problem on Fidel Castro. [El poder de Fidel Castro está basado en el control que tiene Fidel Castro sobre el problema y la dependencia que tiene el problema de Fidel Castro.]

Joseph Stiglitz asserts that transforming to a market economy does not entail a withering away of the state but instead a redefinition

¹⁷ Humberto Leon, personal interview by author, 24 June 1994, Miami, The North-South Center, University of Miami.

of its role [Ref. 48: p. 4]. Considering the case of Cuba, this sentiment is echoed by José Alonso, "The Cuban government should be a partner, a regulator and facilitator, beyond that it fails." [Ref. 49] In summary, if the Castro regime is to remain in control, it must find ways to re-legitimize itself through economic recovery and political revitalization [Ref. 50: p. 7].

2. Civil and Military Opposition

Dominguez observes that opposition to the Castro regime is weakened disproportionately by economic duress, as most Cubans invest virtually all their energies simply to survive. Any opposition remains hampered by a lack of leadership and organization to capitalize on current social and economic hardships [Ref. 1: p. 106]. Only three organizations have sufficient institutional strength to pose serious challenges to the Cuban leadership: a) the Communist Party of Cuba (PCC), b) the Revolutionary Armed Forces (FAR), and c) the Interior Ministry (MININT); all of which remain steadfastly loyal to or inherently controlled by Fidel Castro. So far opposition in Cuba has not been able to (or chosen not to) establish and consolidate itself at either a leadership level, political or military, or within the ranks of the masses [Ref. 20: p. 13]. Local protests, most often manifested by acts of vandalism or petty theft, are directed against economic shortages and presently do not seriously challenge the political system [Ref. 45: p. 31]. This may soon change as consumer goods become more scarce and passive civil disobedience escalates to active civil unrest; forcing the Castro regime to consider economic concessions it previously deemed destabilizing.

a. Civil Discontent

Communist rhetoric, according to Aguila, is rapidly losing its motivational power, and can no longer convince the masses that reliance on ideological convictions will guarantee their subsistence [Ref. 51: p. 98]. Fidel Castro having witnessed the demise of President Mikhail Gorbachev and the irreversible consequences of *perestrioka* and *glasnost* within the Soviet Union, has since deferred to his natural instincts to contain, channel and control any discontent [Ref. 52: p. 145]. Many of Castro's most outspoken critics, such as Catholic bishops and human rights activists, have been publicly admonished or jailed. Baloyra explains the current delineation of domestic priorities: "people are just too preoccupied and busy with subsistence to engage in...spontaneous combustion..." [Ref. 20: p. 21].

The passivity of Cuban civil society may be partly due to the absence of any perceived alternative to Castro [Ref. 53: p. 29]. Falcoff argues that, as long as the crucial second tier of civil and military officials sees its very survival as being associated with that of the Castro regime, it is not likely to rush into precipitous action. There is also a genuine fear of a presumptively revanchist Cuban exile community, which would lay claim to the island and indiscriminately purge those who have collaborated with the regime, even those in fairly minor positions. It is also true that those Cubans who have remained home and paid the price for the Castro regime for nearly two generations will naturally feel that the future is theirs to determine, not those who have spent that period in (what to them will seem) more comfortable circumstances. [Ref. 54: p. 7, 10] The Cuban elite under present

conditions also have no collective interest in Castro's eviction. In fact, the continuation of the existing system is their sole guarantee of survival. [Ref. 55: p. 105]

b. The Revolutionary Armed Forces (FAR)¹⁸

In 1989, the FAR assumed complete control of the entire security apparatus in Cuba, a move that has enhanced the FAR's stature in the government and facilitates government control of the society during the economic crisis. Overall the military seems to be operating on the premise that the government is dealing with the crisis and has an economic plan for recovery that will prevent the breakdown of internal order. The military high command likely believes that the population needs only a little more food and electricity to dispel much of its frustration and anger. The FAR assesses the present crisis as survivable, the economic recovery to be prolonged and arduous, and Castro as the best person to guide the country through the transition. [Ref. 45: pp. 16, 30-33]

The FAR does not appear to be experiencing a breakdown of institutional cohesion or a significant erosion of support for Fidel Castro or the Communist Party, and consequently serves to sustain the regime. The military has been fully in step with the civilian response to what is considered a national emergency. It has thus far supported the government's repressive measures designed to force the population to accept Castro's economic and political reforms. The FAR is unlikely to promote radical changes in the government because

¹⁸ This sub-section relies heavily upon A. B. Montes, The Military Response to Cuba's Economic Crisis, Defense Intelligence Agency, August 1993.

the FAR itself is an integral part of the government.¹⁹ The military budget, estimated to be 11 percent of the national income in 1990, has probably been reduced by almost half in absolute terms. It remains unclear, however, whether that proportion of the national income has also declined. At present the FAR does not consider itself separate from the political process or the final arbiter of political legitimacy in Cuba. [Ref. 45: pp. 5-6, 28-30]

B. THE ECONOMIC AREAS OF FOCUS

The decisions made by the Castro regime in response to the current crisis have thus far focused on three economic areas: the major production sectors of the economy, foreign direct investment and the increasing significance of the black market. Key to any re-equilibration, or recovery strategies within the immediate term are the major sectors of the Cuban economy that are capable of earning hard currency or providing import substitutes. Similarly, the successful attraction of foreign direct investment could considerably factor into the output production matrix of the Cuban economy, particularly if it materializes as sorely needed capital. Additional problems and solutions stem from the coexistence of three distinct tiers within the Cuban economy. The first is the international semi-capitalist tier exclusively reserved for tourists; the second is the official socialist economy that currently fails to meet popular demands; and the third is the legal, semi-legal or illegal private market-oriented economy [Ref. 27: p. 15]. The black market composes the largest

¹⁹ According to A.B. Montes of the Defense Intelligence Agency, those military personnel most disgusted with the situation appear more inclined to defect than protest openly or organize secret opposition.

subset that increasingly dominates within the third tier, yielding both aggravation and reprieve to economic planners. While the black market accelerates the dollarization of the Cuban economy and is contradictory to socialist political and economic aims, it also serves to alleviate some of the economic and social pressures placed upon the second tier and may concurrently quell, or nominally minimize, any widespread civil discontent or disobedience.

A frank study published in Havana by the Center for American Studies estimates that the crippled Cuban economy cannot generate even 40 percent of the income needed to buy essential consumer goods abroad. Cuba's total reserves in hard currency and precious metals fell over 88 percent, from \$102 million in 1991 to \$12 million in 1992. [Ref. 56: p. 48] Cuban officials have said that they believe that the economy can function on a minimum of U.S. \$4 billion of exports per annum. Alonso and Rathbone estimated the 1992-93 export revenues to total between \$2.10 and \$2.65 billion. [Ref. 34: p. 120] These estimates seem to corroborate those made by the *Economist Intelligence Unit*, which reported that hard currency exports were expected to fall from \$2.2 billion in 1992 to \$1.8 billion in 1993 [Ref. 57: p. 194].

According to an internal report prepared for the Cuban Council of Ministers in November 1992: of the 415 basic products that guarantee Cuba's production and are included in the macroeconomic basket, 266 could not be either imported or produced nationally. The availability of the remaining 189 fluctuated between 5 and 26 percent of historical inventories. The report comments that the scarcity of

parts, replacements, components and attachments limits production and transportation, and results in a high incidence of breakages in all types of equipment and minimal or nonexistent maintenance possibilities. [Ref. 58: p. 1] In mid-October 1990, the Ministry of Light Industry reported that 321 factories under its purview had adopted a shortened schedule (24 hours per week) because of shortages of imported raw materials and spare parts; 26 additional factories had been shut down altogether for the same reason [Ref. 11: p. 122]. By January 1993, roughly 75 percent of Cuban factories had simply stopped producing anything because of the lack of raw materials [Ref. 20: p. 9].

1. The Sugar Industry

The sugar industry continues to be Cuba's primary source of foreign exchange. All 156 sugar mills and all sugar refineries in Cuba belong to the Ministry of the Sugar Industry. Sugar marketing is also under state control with domestic rationed quotas distributed through the Ministry of Internal Trade, while CUBAZUCAR is the agency in charge of negotiating and marketing foreign sales [Ref. 59: p. 4]. Agricultural enterprises, cooperatives, and lands of farmers dedicated to sugarcane production account for almost 1.9 million hectares or 46 percent of the total cultivated area in the country, and represent 12 percent of total civil employment. Sugar and its derivatives represent 75 percent of Cuba's total exports, and 18 percent of Cuba's total capital investment and consume one-third of available energy. [Ref. 60: p. 93]

Cuba's sugar milling complex is old; upwards of 90 percent of the factories were built before 1925. The most recent 6 mills were constructed as a result of CEMA commitments made during the period 1981-1987. According to Alonso, the Cuban sugar industry has been subject to a process of decapitalization since 1989, and he estimates that 20 to 30 sugar mills did not grind in 1993. [Ref. 49] The majority of Cuban sugar is manufactured as raws to be further refined by importers. Cuba's capacity to make refined sugar is limited to less than 900,000 tons. [Ref. 61: p. 127] Rivero observes three major problems facing the Cuban sugar industry:

1. serious difficulties in production,
2. loss of traditional preferential markets, and
3. lack of capital for repairs and maintenance.²⁰

Sugar markets abroad demand white sugar, but sugar, as a commodity, has perfect substitutes such as aspartame and high fructose corn syrup. The effects of those perfect substitutes have undermined the size of the market for sugar. In addition, sugar is vulnerable to price fluctuations and trade barriers [Ref. 9: p. 15]. Cuban scholar Miguel Figueras warns that it is difficult to build a normal society in a country that depends almost exclusively on a product whose quantity and price are subject to great fluctuations. The solution to Cuba's problem is to reduce its dependence on sugar, not by means of producing less sugar but rather by developing new enterprises. [Ref. 60: p. 70] Pérez-López sees the Cuban export basket

²⁰ Nicolás Rivero, "Thoughts on the Cuban Sugar Industry," in Cuba in Transition Volume 2: Second Annual Meeting in Miami, Florida, August 13-15, 1992, by the Association for the Study of the Cuban Economy (Miami: Florida International University, 1993), 128.

toward sugar that a shift to commercial terms for its sugar trade will severely reduce Cuba's revenues [Ref. 11: p. 123].

a. Production Output and World Market Absorption

Cuban-American economist José Alonso maintains that Cuba maintains a comparative advantage in sugar production as a result of considerable technical and agricultural expertise. The cost per ton per yield of sugar remains one of the lowest in the world, being most significant in the medium-size estates. Alonso views the major obstacles facing the Cuban sugar industry not as consequences of mill grinding capacity, but as resulting from a lack of supply inputs into the agricultural ("field") industry. Alonso finds gross inefficiency within the Cuban sugar industry as current production levels could be attained using one-third the mills (about 50) and one third the land, approximately 66,000 acres, if the industry were to be privatized. [Ref. 49] Cuban sugar production is down 51 percent since 1989 with the most significant declines occurring in 1993 and 1994, a consequence of high winds, heavy rains, and severe shortages of supply inputs.

The Cuban sugar production output, in metric tons, since 1989 is summarized below:

1989 ^a	8.10 mt
1990 ^a	8.00 mt
1991 ^a	7.62 mt
1992 ^a	7.03 mt
1993 ^b	4.28 mt
1994 ^c	3.6-3.7 mt (estimate)

^a Source: The CRB Commodity Yearbook 1994

^b Source: EIU World Outlook 1994

^c As reported by Mimi Whitefield in, "Cuba sugar harvest is worst in 30 years," *The Miami Herald*, 24 June 1994, 19(A)

The sugar quota policies implemented by developed countries act as a double-edged sword against sugarcane producers: it offers sugar prices that are above the world market level, but it also restricts purchases to such an extent that the exporting countries are forced to dump large quantities of sugar on the free market, or find alternative, preferential trade agreements [Ref. 62: p. 163]. Nearly 75 percent of the world's sugar production is for local consumption and sold by domestic producers at high subsidized price levels. Consequently, the so-called "world market" becomes a residual market, making up less than two percent of sugar sales at a price of 8¢-12¢ per pound, which according to Western experts, does not cover the average cost of production of any sugar exporting country [Ref. 15: p. 30]. About 110 million tons of sugar are traded worldwide, of which only about 10-15 percent is traded at the world market price [Ref. 60: p.]. The EIU reports that the world market price for sugar is projected to be 10¢-11¢ per pound [Ref. 57: p. 196]. In 1989, Cuban sugar exports to the world market totaled 1.65 million tons, and represented a 9.4 percent share of the world market [Ref. 58: p. 27].

b. By-product Diversification

World sugar demand is shifting from raws to refined, or whites, and Cuba must reactively adapt production to world market conditions if it is to remain competitive. Under this reality, diversification away from raw sugar and molasses into a higher value

added product is needed. Such products can be grouped into three categories: sugar, alcohol (such as ethanol for fuel use), and by-products. The sugar-ethanol issue as part of a national sugar strategy could be an attractive option for Cuba within an integrated industry strategy. [Ref. 61: pp. 128, 130]

Cuba is the only producer country with an institution dedicated to the development of sugar derivatives. According to Cuban estimates, less than 15 percent of the potential for developing by-products has been attained. Most of the by-products are derived from bagasse, 51 percent and molasses, 24 percent. [Ref. 13: p. 105] Alonso and Lago contend that the sugar by-products industry could become a mainstay source of new employment and provide the basis for Cuba's diversification away from sugar as a commodity [Ref. 9: p. 21]. Within the same context, Alonso believes Cuba need only produce 4-5 million tons of sugar, 7 million tons maximum, to both meet its domestic requirement (700,000-900,000 tons) and optimize export earnings. [Ref. 49]

2. The Tourism Industry

Cuban government officials project that tourism will be Cuba's primary source of hard currency earnings by the end of this century. Regardless of the outcome, the significance of tourism as an export industry is sure to increase in the near term, considering the obstacles facing other Cuban export enterprises. The economic benefits of tourism result from an improved balance of payments, generation of government revenues, increased income and job creation, and the promotion of growth and development. Espino

provides a caveat however, that "The tourist sector's ability to stimulate economic growth depends on its linkages to the rest of the economy." Thus far, the tourism enclave model adopted by the Castro regime combined with the limitations of the Cuban economy have curtailed the establishment of such intra-industry linkages. [Ref. 63: pp. 57-65] A recent study by La Sociedad Economica, a London-based organization that monitors the Cuban Economy, reported only 12.5 percent of the total gross revenue generated by tourism was spent on local enterprises, and that the tourism sector accounted for only 1.6 percent (62,000 people) of total employment [Ref. 64: p. 133].

In Cuba, tourism is creating social distortions, "tourist apartheid," and is the direct result of a two-currency economy, with dollars used by foreigners and pesos used by the vast majority of Cubans [Ref. 65: p. 822]. Tourism also creates ideological problems for the Castro government, which must justify the expenditure of limited foreign exchange on imported whiskey, and other amenities at a time when most Cubans receive paltry food rations [Ref. 66: p. 129]. Espino notes that Cuban concessions to foreign investors regarding guaranteed profit repatriation and waiver of import tariffs may seriously reduce the potential benefits from international tourism. The economic contribution of tourism to national income and employment is still very small both in absolute terms and in relation to national levels. This, according to Espino, is due to two factors: 1) the low value of the tourism income multiplier;²¹ and 2) constraints on the supply of inputs. [Ref. 63: pp. 62, 65]

²¹ The value of the estimated tourist multiplier for Cuba ranges from .74 to .84, which compares to .88 for Antigua and 1.58 for Jamaica. María Dolores Espino, "Tourism in Cuba: A Development Strategy for the

According to the statistics from the Cuban National Institute of Tourism [Instituto Nacional de Turismo] (INTUR), the total number of tourists and their expenditures have been increasing since 1989:

Year	Visitors	Expenditures (in \$millions)
1989	326,000	250
1990	340,000	250
1991	424,000	287
1992	492,000	382
1993	595,320	466
1994 ²²	600,000(estimate)	561(estimate)

Espino contends that gross receipts do not accurately reflect the true contribution of tourism to the Cuban balance of payments. A better measure is net receipts: gross receipts minus the associated hard currency imports required as inputs. INTUR studies report that between 23 to 64.9 percent of the cost of providing goods and services used by tourist and up to 50 percent of the cost of capital investment in the tourist sector is paid in hard currency. On average within the international tourist industry, the import component is calculated to be about 30-38 percent. [Ref. 63: p. 61] Harvard University professor Jorge Dominguez calculates the annual net currency gain to Cuba in the range of only U.S. \$100-300 million. The growth potential for the Cuban tourism industry seems positive in the

1990s?", *Cuban Studies* 23, ed. Jorge Pérez-López, (Pittsburgh: University of Pittsburgh Press, 1993), 63-64.

²² As reported by Janice Reyes, "Turistas dan la espalda a Miami para viajar a Cuba," *El Nuevo Herald*, 25 June 1994, 1(A), 8(A).

near term, but is not viewed by many experts as boundless. In a recent report, La Sociedad Economica concluded:

Cuba's current lack of access to significant foreign capital and the U.S. tourist market inevitably places a ceiling as to how large and sophisticated Cuba's tourism industry can grow. [Ref. 66: p. 128]

3. Non-Sugar Agriculture Sector

The ability of the non-sugar agriculture sector in Cuba to realize both foodstuff self-sufficiency and export diversification away from sugar is crucial to any strategy of economic recovery. Cuba's agricultural advantages include: soils of excellent quality, a benign subtropical climate with well-defined rainy seasons and a geographic location conducive to trade with its neighbors. The Cuban agricultural program requires imported goods such as fertilizers, seeds, herbicides and equipment, all of which are scarce or degraded due to lack of spare parts and oil products. In 1989, the non-state sector accounted for under 17 percent of cultivated land--provided 65 percent of Cuba's tomatoes and other market vegetables, 28 percent of root crops and 35 percent of plantains. [Ref. 34: pp. 121-122] Van Sickle and Messina assert the lack of advanced technology and limited access to production inputs in Cuba appear to be restricting yields and production more than land, labor and water [Ref. 67: p. 9].

a. Rice

Rice is the most important grain in the Cuban diet. In 1989 there was a total of 205,800 hectares devoted to rice production. Overall total rice production has increased since 1970, and Cuba has been producing an average of over 370,000 metric tons of milled rice

from 1984-1989. Cuba is not self-sufficient in rice production, and must import to satisfy total domestic consumption demands, which averaged 585,508 mt between 1984-1989. Imported volumes have remained relatively stable during the past twenty-four years at about 200,000 metric tons, however, rice has been rationed since the early 1960s; five pounds per month in 1992. Alvarez and Messina claim that the increases in domestic rice production have satisfied the expanding requirements resulting from population growth since imports have remained relatively stable at 30-40 percent of total consumption. [Ref. 68: p. 12]

b. Vegetables

Cuba was a major supplier of fresh vegetables to the U.S. market prior to the U.S. trade embargo against Cuba. Tomatoes and cucumbers were the most significant vegetables imported into the U.S. from Cuba, with avocados, peppers, and eggplant also being imported. Cuban statistics are limited, but do indicate that Cuba increased the area planted in horticultural crops from 91,600 acres in 1970 to 384,500 acres in 1989. Much of the increase in acreage planted in horticultural crops in Cuba occurred in the non-state sector. There is no indication of extensive foreign investment in agricultural production in Cuba at present, however, Chilean produce shippers are said to be preparing to handle the marketing of Cuban fruits and vegetables in the European market [Ref. 67: p. 9].

c. Citrus

Following the 1959 revolution, Cuba invested heavily to develop its citrus industry in order to diversify its sugar-dominated

economy and expand exports to trade partners within CEMA. Citrus acreage increased from about 30,000 acres before the revolution to over 350,000 acres in 1991.²³ Cuba ranks as the 14th largest producer of citrus in the world, producing about 1.0 million metric tons annually. In 1981, CEMA agreed to invest \$350 million into the further development of the Cuban citrus industry. This investment facilitated the introduction of irrigated systems, which led to acreage expansion programs. As a result of these programs, the citrus industry became one of the largest agricultural sectors in Cuba. About 90 percent of total citrus production is state-owned, and although Cuba has considerable technological knowledge, productivity is low. The average per-acre yield for bearing trees of all ages was estimated by the Economic Research Department of the Florida Department of Citrus to be about 110, 90lb boxes, which can be compared to the Florida average of about 350, 90lb boxes. [Ref. 69: p. 1-6]

Most of Cuban citrus production, 44.4 percent of total orange production and 56.9 percent of total grapefruit production, is used for the fresh juice market and is exported. With the loss of import commitments from CEMA countries, Cuba is likely to divert an increasing amount of its citrus exports to western markets in search of hard currency earnings. Recent investments in the Cuban citrus industry by Chile, Israel, Spain and Greece may facilitate access to western markets and increase Cuba's overall market share. [Ref. 69: pp. 7-10] According to CIA trade statistics, Cuban citrus exports, in \$U.S., for the period 1989 to 1992 were:

²³ 21 percent or 73,500 acres of the total is nonbearing citrus acreage.

1989	139 million
1990	150 million (estimate)
1991	100 million (estimate)
1992	70 million (estimate)

d. Tobacco

Hard currency earned from Cuban cigar exports rank behind only sugar, nickel and citrus. Cuba's claim on producing the best cigar in the world has recently been weakened by a major challenge from the Dominican Republic, a shortage of money and recent severe weather crop damage. In 1993, Cuba produced about 257 million cigars, with 200 million sold on the domestic market and the remainder exported, mostly to Europe. According to the CIA estimate of Cuban trade statistics, Cuban tobacco products earned an average of \$U.S. 93.6 million from 1985-1989. In 1993, there was a disastrous downturn in Cuban tobacco as exports fell 10 million short of industry projections.

Exports of Cuban cigars since 1990:

1990	80 million
1991	77 million
1992	67 million
1993	57 million
1994 ²⁴	50 million

The world market for Cuban "Puros," excluding the U.S., is as many as 100 million cigars. [Ref. 70: pp. 114-115] The Cuban tobacco industry has also generated limited foreign interest. The French tobacco firm,

²⁴ As estimated by Cubatabaco Director, Francisco Padron.

Societe Nationale des Tabacs, was reported to be willing to extend a line of credit to Cubatabaco, Cuba's cigar monopoly, in order to aid in the purchasing of equipment and supplies thereby ensuring the French firm a supply of about 6 million cigars this year [Ref. 71: p. 88].

4. Energy

With the exception of bagasse, which is produced and consumed by the sugar industry, Cuban output of energy products is quite modest. There have been no significant coal deposits found in Cuba and hydroelectric resources are limited. The generating capacity of the Cuban public service electrical system reported in 1988 was 3.853 megawatts (MW), with 99.5 percent of this capacity associated with thermoelectric plants fired by residual fuel-oil and crude oil. Consequently, imported energy products are critical to Cuban economic activity. In 1988, total energy imports amounted to about 2.6 times the amount of domestic energy production. Oil and oil products are the most significant Cuban energy imports, satisfying 94 percent of Cuba's apparent consumption of oil in 1988. [Ref. 72: pp. 18-21, 36] Before 1990, Cuba's oil requirement was estimated at 10 million tons per year. According to Rivero, the primary sources of Cuban energy are:

1. petroleum, 73%
2. sugarcane bagasse, 24%
3. firewood, 2%
4. coal and others, 1%.²⁵

²⁵ Nicolás Rivero, "Thoughts on the Cuban Sugar Industry," in Cuba in Transition Volume 2: Second Annual Meeting in Miami, Florida, August 13-15, 1992, by the Association for the Study of the Cuban Economy (Miami: Florida International University, 1993), 128.

In late August 1990, the Cuban government called for energy conservation measures as a result of a 2 million ton shortfall in Soviet oil imports and the lack of hard currency to purchase alternate supplies in the world market. Included among the measures imposed are:

1. reducing daily petroleum and fuel oil deliveries to the state sector by 50 percent and gasoline deliveries to the private sector by 30 percent,
2. scaling back hours of operation in cement and construction material plants; shutting down a nickel processing plant; and halting the start-up of a Soviet-built oil refinery,
3. cutting household electricity consumption by 10 percent, and
4. implementing a nationwide plan to replace agricultural tractors and combines with draft animals.²⁶

It has been estimated that every kilowatt-hour of energy saved or produced in Cuba saves 4.73¢ in foreign exchange [Ref. 73: p. 138].

a. Oil Production/Oil Exploration

Prior to the Soviet collapse, Cuba imported 13 million tons of oil and oil products annually. By 1992, the Castro regime would have but 6 million tons of imported oil with which to manage the Cuban economy. Daily oil production in Cuba is estimated at 20,000 barrels per day, accounting for only one-tenth of its daily consumption. [Ref. 74: p. 147] The state-owned oil company, Cuba Petroleum (Cupet), exercises exclusive control over all oil production, refining

²⁶ Jorge Pérez-López, "The Cuban economy: rectification in a changing world," *Cambridge Journal of Economics* 16 (March 1992): 122.

and distribution in Cuba. According to Cupet vice president, Juan Fleites Melo, efforts to increase domestic oil production through improved technology and increased foreign investment (\$U.S. 30 million in 1993) have resulted in Cuba's capacity to produce 1.3 million to 1.5 million metric tons of oil in 1994. [Ref. 75: p. 115] In June 1994, Fleites Melo lowered Cuba's oil production estimate to 1.1 million metric tons, still twice the production level of 1991, citing recent transport and infrastructure problems as causing the setback [Ref. 76: p. 100]. Cuban domestic oil production since 1991 is tabulated below:

1991	550,000 mt
1992	842,000 mt
1993	1.1 mmt
1994	1.1 mmt (estimate)

In addition, Cuba has explored other alternatives to ease dependence on Soviet Oil such as: 1) attempting to become a beneficiary country under the San Jose Pact, an agreement whereby Mexico and Venezuela offer oil at concessionary terms to Central American and Caribbean nations; and 2) offering to process crude oil from Colombia and Ecuador in Cuban refineries for export, and obtaining compensation for the refining activities in the form of oil products [Ref. 11: p. 124].

In early 1991 Cupet granted a six-year contract to a consortium of French and Canadian oil companies to drill exploratory wells along the Cuban north coast over an area covering 1,800 square-kilometers. The majority of Cuban crude oil is heavy with a high sulfur content, making it difficult to refine. The high costs associated with

oil exploration have prompted the Castro regime to continue its efforts to attract foreign investors. Canadian and European companies were invited to Cuba in February 1993 to bid on concessions to explore for oil within eleven designated blocks covering both onshore and offshore sites. Reportedly, the contracts are to run for 25 years and involve mutual production responsibilities with the foreign companies providing all necessary capital and technology. [Ref. 77: p. 96] In June 1994, Cupet announced that Sherritt Inc., one of the largest Canadian investors in Cuba, had discovered crude oil of a higher quality than any previously found in Cuba. The well in the Bay of Cardenas could produce 3,750 barrels per day. [Ref. 78; p. 87] The Cuban economy could experience rapid recovery should future oil exploration in Cuba uncover significant oil reserves. Gonzalez comments that even though it would take five to seven years to bring a discovery into production, the very promise of Cuba becoming a major oil producer would free up Western credits and loans to the Cuban government in the interim [Ref. 15: p. 25].

b. Nuclear Power

Pérez-López claims the shift to market prices and convertible currencies in Cuban-Soviet trade in energy products is likely to accelerate efforts to alter the structure of energy supply, by emphasizing alternate energy sources, especially nuclear power [Ref. 72: pp. 17, 18]. In 1974, Fidel Castro announced that the construction of the Juragúa nuclear power complex would begin in 1977-78. The reactors for the Juragúa plant are Soviet-designed pressurized water reactors with 440 MW electricity generation

capacity, known as VVER-440. [Ref. 72: p. 35] The Juragúa nuclear plant was expected to supply 15 percent of Cuba's electrical power needs. The first reactor is apparently more than 90 percent complete, however, any further construction appears to be indefinitely postponed due to lack of money to pay Russian technicians and fund modifications required to meet international atomic energy safety standards. [Ref. 79: p. 143] Cuba's ability to build, complete and operate the Juragúa plant and others depends on ex-Soviet aid and assistance, and will remain at an impasse unless assistance from another nation such as Japan or Germany are obtained. [Ref. 80: pp. 107, 108] Despite the international concern over the plant's safety and the nuclear accident at Chernobyl, the long-term commitment of the Cuban government to nuclear power does not seem to have been affected [Ref. 80: p. 100]. During a portion of his 26 July 1986 national address Fidel Castro stated his view on pursuing nuclear power:

...for our nation, the use of this new energy source, nuclear energy, is essential, since we do not have any other alternative.

Pérez-López surmises that the marginal cost of producing electricity in the nuclear power plants being built in Cuba would be lower than that in oil-fired thermoelectric plants. The shift to nuclear power would reduce consumption of oil and oil products, which now have to be procured using hard currency.²⁷ According to Cuban officials, each 440 MW nuclear reactor will have the potential to

²⁷ In April 1994, the ratification phase of an agreement reached in December 1993 between Cuba and Russia to exchange 1 million tons of raw sugar for 2.5 million tons of oil had been concluded.

displace thermoelectric generation capacity consuming 600,000 metric tons of oil products per annum. Nuclear power may offer Cuba the only realistic possibility to reduce dependency on imported oil and oil products in the medium term. It will not reduce the overall dependence on imported energy, however, as hardware for the application of nuclear technologies is imported, and so are fissionable materials. [Ref. 72: p. 37-39]

5. Nickel

Cuba has the fourth largest reserves of nickel in the world, over 900 million tons of probable reserves, and is the sixth largest producer of nickel. Its ores, however, are of low-to-average grade which are expensive to process. The average world production cost in January 1993 was about U.S. \$6500 per ton. Assuming an average world market price of U.S. \$6500 per ton for 1992, Cuban nickel profits for that same year are estimated to be U.S. \$200-220 million. Estimates of Cuban nickel production are roughly 35,000-45,000 tons for 1993 close to that produced in 1992 and 1991. Cuba could conceivably remain in the world nickel market if production costs are reduced and efficiency improved. [Ref. 81]

Eastern Europe and the former Soviet Union were both chief buyers of Cuban nickel and the main source of many supply inputs. Cuban nickel production has an installed capacity of 70,000 metric tons per year. All three Cuban nickel plants, Moa, Punta Gorda and Nicaro, are said to make an operating profit even at low nickel prices of around \$2.10 per pound (U.S. \$4200 per ton) but Moa is the most profitable because of its low fuel input. A fourth plant is under

construction at Las Camariocas whose design capacity is 30,000 metric tons per year. The Las Camariocas plant is 70 percent complete and is designed to operate with about 5 metric tons of crude oil per ton of nickel produced compared to the 15-20 tons of oil required at the other three plants. [Ref. 82: p. 148] Mining is necessarily a long term venture but Cuba has the advantage of an extremely prospective terrain, an extraordinary level of geological knowledge built up over 35 years, a well educated workforce, and there a sufficient number of mining professionals. [Ref. 83]

Cuban nickel output in thousands of tons according to the International Nickel Studies Group, Amsterdam, Netherlands, 1994:

1989	46.3
1990	40.8
1991	33.3
1992	32.2
1993	32

6. Biotechnololgy

Another expanding arena for Cuban trade is biomedical technology. A concrete result of Cuba's well respected medical system has been the development of at least two products that have potential in the international market--a Hepatitis B vaccine and Streptokinase, an anti-stroke medicine. Cuban officials are well aware of the complexities of breaking into an international drug market dominated by United States and European multinational companies, but they are formulating market strategies focused primarily on the poorer countries, notably in Latin America. The success of just one key

product could significantly boost this sector of Cuba's economy which is estimated to earn \$200 million a year in hard currency. [Ref. 84: pp. 142-144] There were early quality control problems in production of some Cuban meningitis B vaccines sold to Brazil. In spite of this, the present effectiveness of the meningitis vaccine is estimated at 85 percent, which is considerably above the competing products with a reported effectiveness closer to 65 percent. [Ref. 21: p. 413]

7. Foreign Direct Investment

Foreign investment in joint ventures has been permitted in Cuba since 1982. By January 1992, there were fifty-five joint venture or production-sharing operations underway in Cuba. The majority were in tourism, but during 1991, they expanded into biotechnology, pharmaceuticals, nickel, oil, textiles, construction, sugar derivatives, transportation, cosmetics and food processing, with one-hundred more such ventures under negotiation. In November 1993, Carlos Martinez, president of Cuba's Chamber of Commerce, reported there were 481 foreign companies with offices in Cuba. Benglesdorf characterizes the policies undertaken by the Castro regime with regard to establishing joint ventures in Cuba as "In effect,...a de facto transition to a mixed economy." [Ref. 52: p. 169] According to Montes, foreign exchange receipts from foreign direct investment remained fairly constant at \$50 million per year from 1989-1992 [Ref. 45: p. 35]. As part of the foreign investment incentive package proposed by the Castro regime, investors are allowed to import foreign management teams, however, the Cuban government retains the right to reallocate labor to and from joint ventures. It also retains the right

to select the pool of domestic workers from which the foreign enterprise may hire. [Ref. 21: p. 412] [Ref. 65: p. 822].

Lasaga believes the success of the so-called "maquiladoras" in Mexico could be replicated in Cuba, particularly in the area of textiles, electronics and pharmaceuticals. Like Mexico, Cuba has the advantage of close proximity to the U.S. market. Lasaga also notes that free capital repatriation could encourage foreign investors to make only short-term investments that would maximize their returns, instead of longer-term projects that would be driven by market fundamentals. [Ref. 85: pp. 309-310] Foreign direct investment agreements have also served as alternative measures by which Cuba may service its foreign debt. Mexico's Grupo Domos Internacional has acquired a 49 percent stake in Entelcuba, the Cuban telephone monopoly, with a Domos official noting that it is paying U.S. \$1.44 billion for its share, of which about U.S. \$200 million will be obtained in a swap deal liquidating Cuba's debt with Mexico. Domos will be investing a further U.S. \$740 million over seven years in modernizing Entelcuba. [Ref. 86: p. 5]

Glazer expresses the irony of the "bifurcation" of the Cuban economy, in part caused by the foreign investment policies of Fidel Castro:

By not permitting market activity within the domestic economy while selling off chunks of the island to foreign investors, the government has taken a path that benefits those who least support the revolution [Ref. 65: p. 823].

Baloyra sees the very generous terms offered by the Cuban government as having two negative effects in the short term: 1) Cuban participation

in profits is but a fraction of what it could be if the country did not find itself in such a weak position, and; 2) extensive concessions in taxation, profit repatriation, and the provision of infrastructure reduced national participation in the surplus generated by these activities and deflated the net diffusion effects of this investment in the domestic sector. [Ref. 20: p. 17]

8. The Black Market

The economic function of the distribution sector in Cuba is to transfer goods and services from producers to consumers. Within Cuba there are three interrelated factors that play a key role in the functioning of the distribution sector:

1. the rationing system,
2. alternative markets, and
3. informal exchanges.²⁸

The drastic reduction of imported consumer goods and the lack of domestic substitutes has caused the list of consumer goods which are now rationed by the Cuban government to be expanded to include even the most basic items, such as aspirin, milk and eggs. By rationing consumption, the Cuban government attempts to guarantee the satisfaction of basic needs independent of levels of disposable income resulting from salaries and wages [Ref. 9: p. 13]. For the majority of Cubans, however, the state is unable to meet its commitment, and whatever cannot be procured by barter must be purchased, in dollars, on the black market.

²⁸ Roger R. Betancourt, "The Distribution Sector in a CPE: Cuba," in Cuba in Transition Volume 2: Second Annual Meeting in Miami, Florida, August 13-15, 1992, by the Association for the Study of the Cuban Economy (Miami: Florida International University, 1993), 211.

The black market, often referred to as the "second economy," reflects a disparity between supply and demand. More importantly, according to Eckstein, the existence of the Cuban black market reflects the failure of Fidel Castro's rectification policies to keep the supply of goods available through legitimate channels in line with the available money supply. It also reflects the state's inability to impose its will when in conflict with valued social concerns. [Ref. 16: p. 82] As put forth by Pérez-López, some of the characteristics of CPEs which account for the "pervasiveness and dynamism" of their second economies include:

1. government ownership of the means of production,
2. tautness and rigidity of central plans, and
3. suppressed inflation.²⁹

In some cases, the second economy may complement the official, centrally-planned economy or "first economy," and correct some of its failures [Ref. 87: p. 185]. The black market can also result in economic distortions that spawn additional, less desirable consequences.

The unavailability of consumer goods through official channels has led to excess liquidity and a lack of incentives to work, thereby lowering productivity [Ref. 14: p. 828]. Montes estimates that Cubans spend 50-70 percent of their money on the black market [Ref. 45: p. 31]. Cuba has nearly 12 billion excess pesos in circulation, and Cubans

²⁹ Jorge Pérez-López, "The Cuban Second Economy: Methodological and Practical Issues Related to Quantification," in Cuba in Transition Volume 2: Second Annual Meeting in Miami, Florida, August 13-15, 1992, by the Association for the Study of the Cuban Economy (Miami: Florida International University, 1993), 187.

find the excess nearly impossible to spend because there is so little to buy [Ref. 88: p. 87]. Unofficial estimates are that \$400 million is currently circulating in the black market, with prices on the black market 10-20 times higher than at state distribution centers [Ref. 89: p. 95]. Ritter argues that under these conditions both the officially tolerated and the illegal components of the informal sector are likely very large [Ref. 31: p. 122]. The high level of private economic incentives for informal sector activities can only be countered by increasing the costs of informal sector participation, presumably through a higher level of repression or moral persuasion³⁰ [Ref. 90: p. 213].

9. The Dollarization of the Cuban Economy

The possession of U.S. dollars, forbidden since 1961, became legal in Cuba on August 14, 1993. Cubans can now spend U.S. dollars, meaning that those who either earn money abroad or have money sent to them by friends or relatives will be able to buy goods in hard currency shops that are not available in state stores, which stock only rationed goods. With these measures, the Castro regime hopes to encourage Cuban exiles to send millions of dollars, that will eventually add to the hard currency holdings of the government, to desperate relatives. It also hopes to drain the U.S. currency from the Cuban black market. [Ref. 91: p. 134] Alonso considers this logic as being flawed, since in the first round of circulation the influx of dollars go

³⁰ On May 2, 1994, Fidel Castro announced that the government would confiscate all property illegally acquired by black marketeers. Just one month earlier, operation "Giron 94," resulted in hundreds of Cubans being fined, warned or charged with corruption, for their black market activities.

directly to the black market anyway. It is not until the fourth or fifth round of circulation that the Cuban government realizes any benefit, thus forcing the Cuban government to print more pesos; fueling inflation. [Ref. 49]

The introduction of the dollar as legal tender, and the associated parallel market it creates, results in two phenomena with which the Cuban government has no experience--inflation and an affluent and "independent" social class [Ref. 92: p. 146]. Andres Oppenheimer theorizes that Castro risks losing political control over a large sector of the population that will no longer depend on the Cuban government for its livelihood. Those Cubans with access to dollars will evolve into a new privileged class. [Ref. 93: p. 132] For the strategy of Fidel Castro to work, the government will have to remain the exclusive banker and retailer of all items that will be allowed to be purchased with dollars. It must ensure the replenishment of goods that can be purchased at state-owned dollar stores. The Castro regime must also implement measures by which to control inflation and retard devaluation of the Cuban peso. [Ref. 92: p. 146] Dominguez views the dollarization of the Cuban economy as "a very big step," because for the first time, "the government has renounced the political right to intervene in an economic transaction." Such a relaxation policy has made some officials fearful that professionals (doctors and engineers) who spent years studying may now leave their jobs for less prestigious but more profitable positions and activities where the access to dollars is much greater. [Ref. 94: p. 137]

10. Cuba's Foreign Debt

Cuba has amassed a foreign debt in excess of \$39 billion, of which an estimated \$7 billion is owed to the Paris Club and the balance to the former Soviet Union and countries of Eastern Europe [Ref. 44: p. 106]. In 1992, Alonso and Rathbone estimated the Cuban foreign debt to be 1.6 times the Cuban GSP for 1989, representing a per capita debt of over \$3,900 [Ref. 35: p. 118]. Zimbalist notes that Cuba has also been seriously affected by a steady devaluation of the U.S. dollar against the currencies of other OECD economies since mid-1985. According to Zimabalist, 87 percent of the Cuban foreign debt is denominated in nondollar currencies, yen and European currencies. Many of these currencies have appreciated against the U.S. dollar by over 40 percent since mid-1985 and continue to do so, and as a result the dollar value of Cuba's foreign debt has increased proportionately. [Ref. 13: pp.156-157] In 1986 Cuba suspended its payments on the \$7 billion it owed to Western nations [Ref.43: p. 133]. A repayment agreement with creditors is urgent since Cuba must now conduct most of its trade on cash-only terms. In addition, new credits are required for investments aimed at increasing both productivity and foreign exchange earnings [Ref. 31: p. 137].

11. External Policies of Regional/International Actors

The most widely debated external policy affecting Cuba remains the U.S. imposed trade embargo. On January 3, 1961, the U. S. severed diplomatic relations with Cuba. The following year Cuba nationalized American property valued at approximately \$U.S. 1.8 billion [Ref. 95: pp. 102-104]. The U.S. State Department believes it

can best foster an environment for peaceful change in Cuba by continuing to isolate the Castro regime diplomatically, politically and economically until basic human rights are respected and democratic reforms enacted [Ref. 96: p. 577]. U.S. policy has remained virtually unchanged for over 30 years and is considered by its advocates, including Ambassador Michael Skol, to be a valuable bargaining chip:

If we were to change our policy now, what leverage would remain to pressure that regime toward freedom and democratic openings [Ref. 97].

Ritter argues that Cuba can strengthen its position to benefit from normalization with the U.S. by establishing a successful export-oriented economic structure and trading system [Ref. 31: p. 144]. However, the U.S. embargo, intensified by recent legislation, prohibits such events from occurring in the near term. The Cuban Democracy Act (CDA), signed on October 23 1992 by then President Bush, has as its principal provisions the ban of most U.S. subsidiary trade with Cuba and excludes any vessel that stops in Cuba from entering U.S. ports for 180 days thereafter [Ref. 95: p. 104]. In addition, section 1704 of the CDA authorizes the President to suspend foreign assistance to any country that provides assistance, including loans, leases or credits at non-market rates to Cuba [Ref. 98].

During the post-Cold War period international support of U.S. Cuban policy and Cuba's isolation has waned. In late-1992, United Nations Resolution 4719 called for the termination of the U.S. economic, commercial and financial blockade against Cuba. The U.S. voted against the resolution and received support from only Israel and Romania. In mid-December 1993, the Caribbean Community

(Caricom) established a Caricom-Cuba joint commission, which declared as its objective the strengthening of ties through the identification and promotion of opportunities for cooperation in the economic, social, cultural and technological fields. The accord creating the commission identified 24 priority areas, including trade, farming, fisheries, biotechnology, and human resources development. [Ref. 99: pp. 1-2] Many high-ranking officials of the Organization of American States (OAS) have informally discussed the reinsertion of Cuba into the OAS, and may soon elect to append the issue to the organization's formal agenda. Other nations, representing a wide spectrum of political and economic ideologies, have established economic relations with Castro's Cuba either through joint ventures or other bilateral agreements. Cuba has thus far succeeded in securing economic commitments of varying degrees from such countries as Canada, France, Spain, Mexico, Russia, North Korea, China, Vietnam, and the United Kingdom.

IV. SPECIFICATIONS OF THE FORECAST

A. STATES OF NATURE

The hypotheses put forth in a Bayesian analysis are mutually exclusive and exhaustive and serve to specify the possible "states of nature", or outcomes, with respect to a particular issue [Ref. 4: p. 85]. For the purposes of this study the systemic forces at work in the environment are such that the possible states of nature characterizing the Cuban economy are: a centrally planned economy (CPE), a mixed economy (MIX) or a predominantly market economy (MKT). Each of the possible outcomes is assigned a prior probability representing the assessor's degree of belief concerning the truth of the various hypotheses [Ref. 4: 56]. Based on the recent works of Mesa-Lago and Fabian (1993), Ritter (1993), and Gonzalez and Ronfeldt (1994) the following prior probabilities are assigned to the economic direction of the Cuban economy in the short-to-medium term:

<u>Probability</u>	<u>Justification</u>
P(CPE) = .20	(the former dependence upon Soviet subsidy and the CEMA trade bloc has left Cuba without economic support in time of crisis)
P(MIX) = .65	(the bifurcation of the Cuban economy and the concern for preserving social gains)
P(MKT) = .15	(the steadfast reluctance of Fidel Castro to accept market reforms and capitalism)

B. TARGET VARIABLES

Target variables, within a Bayesian context, represent those factors, pieces of evidence or activities readily translated into events from which revised conditional probabilities of the possible hypotheses are assessed. According to fundamental probability theory, two events are independent if the probability assigned to one event is unaffected by the knowledge that the other event has occurred. The conditionally independent form of Bayes' Theorem can only be used if it can be justified mathematically, often an arduous theoretical exercise. In the case of economic or political applications, prior events may in fact be essential to formulating a valid probability assessment and therefore, using conditional dependence represents a more accurate and realistic approach. [Ref. 4: pp. 144-150] There are several target variables, dependent on other activities, that are relevant to the possible hypotheses regarding the Cuban economy. Although several more could be postulated, six target variables assumed to be conditionally dependent have been chosen:

1. Foreign Exchange Earnings,
2. Import Substitution,
3. Political Control,
4. Economic Reforms,
5. Financial Integration into Global Financial Community, and
6. External Policies of International and Regional Actors.

Each of the target variables is derived from the economic and political considerations previously examined. The analytical translation of these variables into relevant events (E1-E6) is discussed below.

1. Event 1-- Foreign Exchange Earnings Exceed \$4 bn.

Cuban foreign exchange earnings are a direct calculation of the revenues generated by both the commodity and service sectors added to foreign direct investments. The earning potential of major Cuban exports such as sugar and nickel will depend not only on production output but also on world market prices, unless more favorable bilateral agreements materialize. Increased foreign direct investment in the form of joint ventures may partially compensate for the low world prices of Cuban commodities particularly if selected industries become more efficient and benefit from long-term capital.

2. Event 2 -- Import Substitution Meets 50% of Consumption

The most significant import substitution efforts undertaken by the Castro regime address energy and foodstuff self-sufficiency. The lack of energy inputs severely curtails the production output of Cuba's most important industries. In addition, regularly scheduled electricity blackouts throughout the country serve as a daily reminder of the unabated crisis conditions, and may soon begin to negatively affect the lucrative tourism sector. A significant discovery and refinement of Cuban oil reserves or the completion and successful operation of the Juragúa nuclear plant could lessen energy rationing restrictions, but neither is expected in the near term. The satisfaction of consumer demand for foodstuffs represents a prominent catalyst of civil unrest. Should Cuba earn sufficient foreign exchange to purchase 30 to 40 percent of its foodstuffs abroad, and should import substitution meet 50 percent of domestic consumption, the remaining 20 to 10 percent can be absorbed by private production or the black market.

3. Event 3 -- Political Control is Maintained by Castro

Maintaining political control within Cuba involves the Castro regime being able to respond quickly and decisively to civil or military challenges. Central to this issue is the ability of the Castro regime to sustain its claim of legitimacy in the face of alternate claims from outside the regime. Activities that threaten political control include the increased influence and organization of domestic opposition such as dissident groups and the Catholic Church, and escalating public demonstrations protesting economic conditions [Ref. 96: p. 366]. Black market activity may also provide information indicative of the potential for civil discontent or disobedience. Should staple consumer goods become increasingly scarce, even on the black market, the unofficial exchange rate (peso/dollar) will rise, reflecting inflationary pressures. Inflation of black market prices left unchecked could ultimately result in desperate popular actions, such as food riots or the looting of government warehouses and stores.

4. Event 4 -- Economic Reforms Result in Less Centralization

The relevant economic policies include those affecting institutional structures, as well as both internally and externally oriented policies [Ref. 34: p. 19]. The internal and external economic policies that result in less centralization include: liberalizing prices, privatizing state industry, instituting tax reform, adopting a realistic exchange rate, restructuring incentive policies, reducing state subsidies, and encouraging private enterprise. The tradeoff is a loss of state control over the allocation of resources and economic activity, from which income distribution inequalities result.

5. Event 5 -- Integration into the Global Financial Community

A major obstacle thwarting the intergration of Cuba into the global financial community is its inability to service a \$7 billion debt owed to the Paris Club. The effect of Cuba paying its foreign debt is to reduce the foreign exchange available for imports and investments. For Cuba to cover interest and principal on its debt an increased trade surplus or a renegotiated repayment schedule is necessary. Cuba is not a member of the International Monetary Fund nor the World Bank and therefore is unable to secure desperately needed financial credits. Prospective lender-nations remain skeptical of Cuba's economic and political future and are reluctant to extend credit other than in the form of investments in joint ventures, or "debt swap" deals as accomplished by Mexico. Should significant oil reserves be discovered in Cuba, access to financial credits would be considerably facilitated.

6. Event 6 -- Foreign Trade/Aid Policies Benefit Cuba

The external foreign policies of international and regional actors such as the U.S., U.N., OAS, and CARIBCOM could quite literally throw Cuba a lifeline. Such action would entail development aid similar to that pledged to the economic reconstruction of Haiti following the return of exiled president Jean-Bertrand Aristide in mid-October 1994. The most debated foreign policy issue remains the lifting of the U.S. trade embargo, which undoubtedly would increase foreign investment but not necessarily eliminate tension between the two countries, considering the \$1.8 billion in expropriated properties claimed by American businesses and the \$7 billion claimed by Cuban exiles.

C. SCENARIO FORECASTS

The scenario forecasts assume the continuation of Fidel Castro in a position of unchallenged political and economic leadership into at least the medium term (5-8 years). Under the first five scenarios, U.S. policy toward normalizing relations with Cuba and lifting the embargo remains unchanged, as does Cuba's indefinite moratorium on the servicing of its foreign debt. Under these conditions, Event 5 and Event 6 can be excluded from Scenarios I-V.

A word of caution is necessary with respect to the specific time order of relevant events. If no specific time order can be specified for the events under consideration, different orders will represent different composite events and one should expect to calculate different final products for the different probability judgements assigned [Ref. 4: p. 168]. Event 1 through Event 6 have been placed in a logical order of succession without regard for the discrete time intervals between successive events. Event 1 through Event 4 are interchangeable; however, Event 5 and Event 6 most likely would succeed Event 1 through Event 4 regardless of their order. All assigned probabilities are subjective, and are intended to appeal to the prescience of the reader.

Due to the initial definition of Event 4, the conditional probability, $P(E4|H1)$, is assigned a low value and factors to significantly decrease $P(CPE)$ regardless of the sequence of relevant events. For this study Event 4 is considered an applicable variable to the direction of the Cuban economy, and therefore has been included in each scenario.

1. Scenario I-- Events Occur 1-2-3-4

Scenario I reflects the limitations of a Cuban CPE with respect to earning foreign exchange receipts in excess of \$4 billion; considerably more favorable conditions exist under a mixed or market economy. The sequence of events is ordered E1-E2-E3-E4. Table 1A lists the prior probability of each hypothesis, the conditional probabilities associated with the sequence of events, and the revised probabilities calculated after the sequence has occurred.

j	$P(H_j)$	$P(E_1 H_j)$	$P(E_2 E_1 \& H_j)$	$P(E_3 E_2 \& E_1 \& H_j)$	$P(E_4 E_3 \& E_2 \& E_1 \& H_j)$	Rev. Prob. of H_j
1	.20	.05	.35	.70	.10	.0018
2	.65	.45	.55	.80	.65	.5982
3	.15	.65	.75	.90	.85	.4000

Table 1A. Assigned Probabilities for Scenario I

The generalized trends of the Cuban economy subsequent to the given sequence of relevant events for Scenario I are depicted in Figure 1.

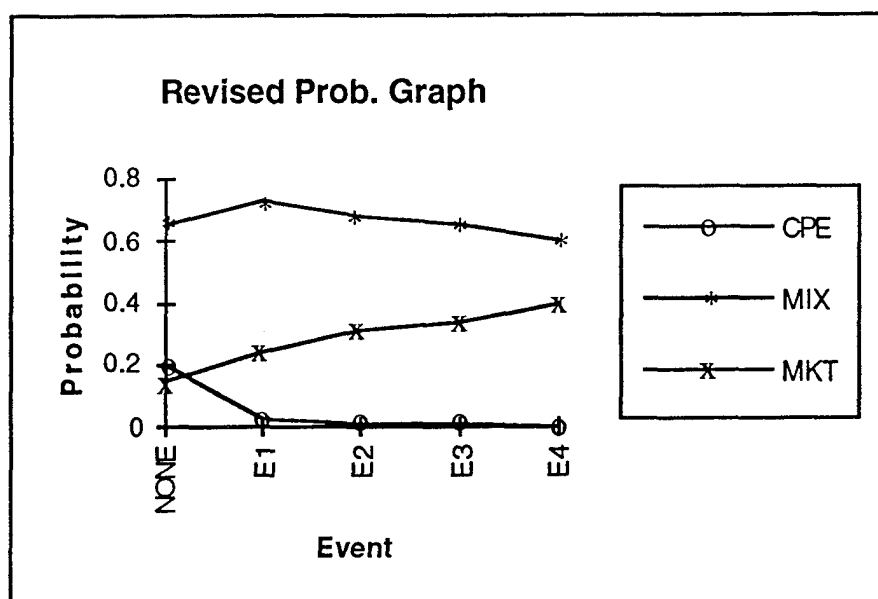


Figure 1. Revised Probability Graph for Scenario I

As each relevant event occurs the probability of each hypothesis (CPE, MIX, MKT) is recalculated (revised) using Bayes' theorem. These results are listed in Table 1B, and correspond to data points which determine the revised probability graph in Figure 1.

Event	P(CPE)	P(MIX)	P(MKT)
NONE	.200	.650	.150
E1	.025	.731	.244
E2	.015	.677	.308
E3	.012	.653	.334
E4	.002	.598	.400

Table 1B. Revised Probabilities for Scenario I

Under the conditions of Scenario I the assigned probability of each hypothesis was affected by the associated sequence of events as follows: P(CPE) decreased by 99.1%; P(MIX) decreased by 8%; and P(MKT) increased by 167%.

2. Scenario II-- Events Occur 4-3-2-1

Scenario II considers the same pretense as in Scenario I, but instead assumes the events occur in reverse order. The sequence of relevant events is thus ordered E4-E3-E2-E1. Similar to the previous case, Table 2A lists the prior probability of each hypothesis, the conditional probabilities associated with the sequence of events, and the revised probabilities calculated after the sequence has occurred.

j	P(H _j)	P(E4 H _j)	P(E3 E4&H _j)	P(E2 E3&E4&H _j)	P(E1 E2&E3&E4&H _j)	Rev. Prob. of H _j
1	.20	.10	.40	.25	.25	.006
2	.65	.65	.65	.45	.40	.620
3	.15	.85	.85	.55	.50	.374

Table 2A. Assigned Probabilities for Scenario II

The generalized trends of the Cuban economy subsequent to the given sequence of relevant events for Scenario II are shown in Figure 2.

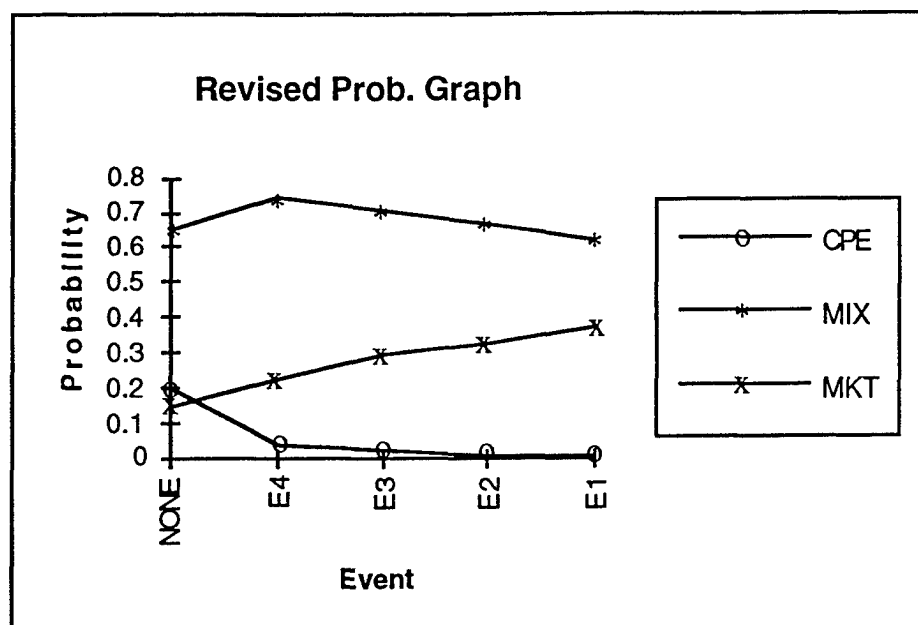


Figure 2. Revised Probability Graph for Scenario II

As before, the revised probabilities associated with the occurrence of each relevant event have been calculated and appear in Table 2B.

Event	P(CPE)	P(MIX)	P(MKT)
NONE	.200	.650	.150
E4	.035	.741	.224
E3	.020	.702	.277
E2	.011	.667	.322
E1	.006	.620	.374

Table 2B. Revised Probabilities for Scenario II

Under the hypothetical conditions of Scenario II: P(CPE) decreased by 97%; P(MIX) decreased by 4.6%; and P(MKT) increased by 149%.

3. Scenario III-- Events Occur 3-4-2-1

Scenario III considers the conditions under which both political control and decentralization are less likely to occur coincident with a

CPE. Under this scenario the Cuban government would fail to provide the most basic foodstuffs or no longer guarantee the social gains of the revolution. As a result, civil opposition would increase its demands for more market reforms and less centralization. The sequence of relevant events is ordered E3-E4-E2-E1. As before, listed in Table 3A are the prior, conditional, and revised probabilities.

j	$P(H_j)$	$P(E3 H_j)$	$P(E4 E3\&H_j)$	$P(E1 E4\&E3\&H_j)$	$P(E2 E1\&E4\&E3\&H_j)$	Rev. Prob. of H_j
1	.20	.40	.20	.25	.25	.018
2	.65	.60	.40	.45	.40	.522
3	.15	.80	.75	.55	.50	.460

Table 3A. Assigned Probabilities for Scenario III

The generalized trends of the Cuban economy subsequent to the given sequence of relevant events for Scenario III are depicted in Figure 3.

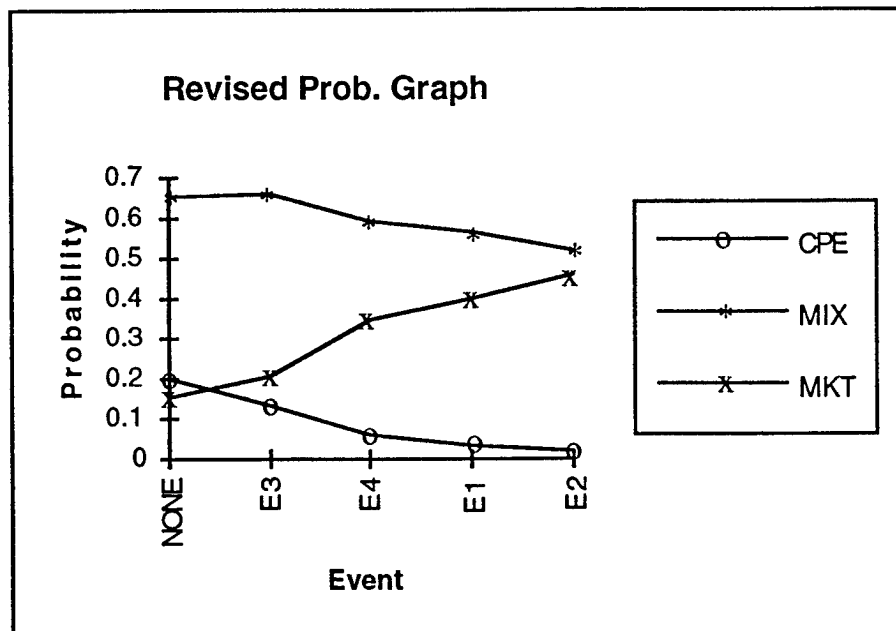


Figure 3. Revised Probability Graph for Scenario III

The revised probabilities associated with the occurrence of each relevant event appear in Table 3B.

Event	P(CPE)	P(MIX)	P(MKT)
NONE	.200	.650	.150
E3	.136	.661	.203
E4	.061	.595	.344
E1	.032	.568	.400
E2	.018	.522	.460

Table 3B. Revised Probabilities for Scenario III

Under the hypothetical conditions of Scenario III: P(CPE) decreased by 91%; P(MIX) decreased by 19.7%; and P(MKT) increased by 207%.

4. Scenario IV-- Events Occur 2-3-4-1

Scenario IV reflects the condition under which import substitution efforts to meet 50 percent of consumption needs are not likely to succeed in the near term regardless of the economic system in place. The sequence of relevant events is ordered E2-E3-E4-E1. Similar to the previous cases, Table 4A lists the prior probability of each hypothesis, the conditional probabilities associated with the sequence of events, and the revised probabilities calculated after the sequence has occurred.

j	P(H _j)	P(E2 H _j)	P(E3 E2&H _j)	P(E4 E3&E2&H _j)	P(E1 E4&E3&E2&H _j)	Rev. Prob. of H _j
1	.20	.10	.65	.20	.25	.002
2	.65	.20	.75	.40	.45	.543
3	.15	.30	.85	.70	.55	.455

Table 4A. Assigned Probabilities for Scenario IV

The generalized trends of the Cuban economy subsequent to the given sequence of relevant events for Scenario IV are depicted in Figure 4.

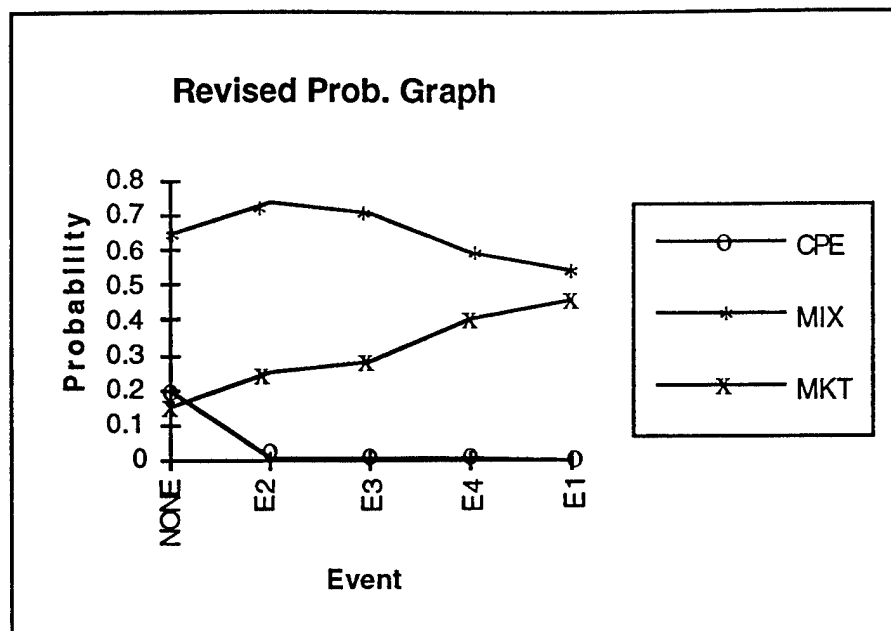


Figure 4. Revised Probability Graph for Scenario IV

The revised probabilities associated with the occurrence of each relevant event appear in Table 4B.

Event	P(CPE)	P(MIX)	P(MKT)
NONE	.200	.650	.150
E2	.011	.734	.254
E3	.009	.711	.279
E4	.004	.590	.405
E1	.002	.543	.455

Table 4B. Revised Probabilities for Scenario IV

Under the hypothetical conditions of Scenario IV: P(CPE) decreased by 99%; P(MIX) decreased by 16.5%; and P(MKT) increased by 203%.

5. Scenario V-- Equiprobable Hypotheses

Scenario V assumes that each of the three hypotheses has an equal probability of occurring, i.e., $P(CPE) = P(MIX) = P(MKT) = 0.333$. Such an equiprobable occurrence is most unlikely in the case of Cuba, however, it will be examined to illustrate an initial lack of information

or intuition. The condition represents an assessor's judgment that the situation is independent of the probabilistic outcome of each economic system prior to the sequence of relevant events. The remaining assigned probabilities are identical to Scenario I as is the sequence of relevant events, which is ordered E1-E2-E3-E4. Listed in Table 5A are the prior, conditional, and revised probabilities.

j	$P(H_j)$	$P(E1 H_j)$	$P(E2 E1 \& H_j)$	$P(E3 E2 \& E1 \& H_j)$	$P(E4 E3 \& E2 \& E1 \& H_j)$	Rev. Prob. of H_j
1	.333	.05	.35	.70	.10	.002
2	.333	.45	.55	.80	.65	.256
3	.333	.65	.75	.90	.85	.742

Table 5A. Assigned Probabilities for Scenario V

The generalized trends of the Cuban for Scenario V appear in Figure 5.

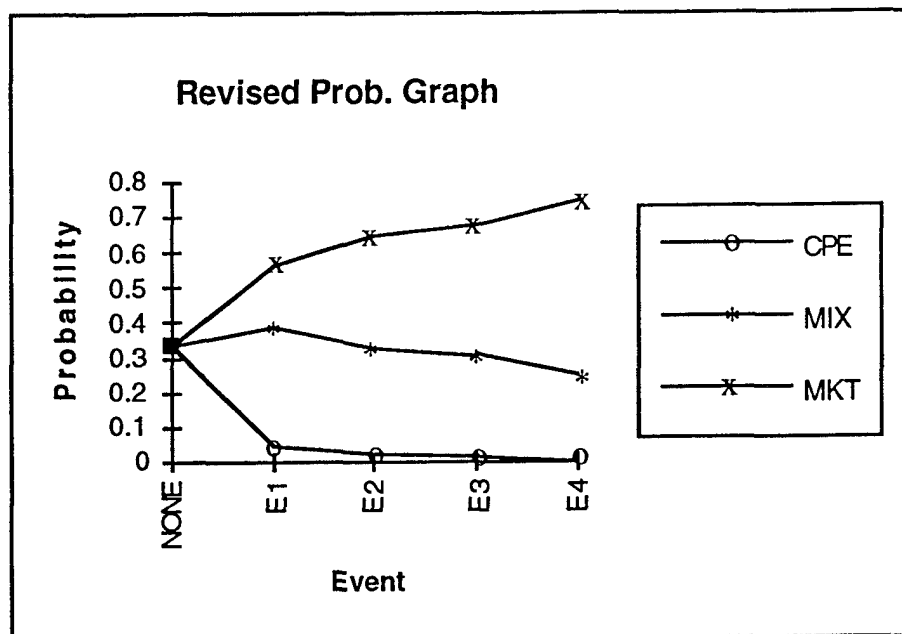


Figure 5. Revised Probability Graph for Scenario V

The revised probabilities associated with the occurrence of each relevant event appear in Table 5B.

Event	P(CPE)	P(MIX)	P(MKT)
NONE	.333	.333	.333
E1	.043	.391	.565
E2	.023	.329	.648
E3	.019	.305	.676
E4	.002	.256	.742

Table 5B. Revised Probabilities for Scenario V

Under the hypothetical conditions of Scenario V: P(CPE) decreased by 99.4%; P(MIX) decreased by 23.1%; and P(MKT) increased by 122.8%.

6. Scenario VI-- A Road to Recovery

Scenario VI is identical to Scenario I, with the additions of Event 5 and Event 6. This scenario incorporates the conditions that allow for Cuba's foreign debt to come under control and the external trade policies of other nations and organizations to significantly benefit Cuba; neither is expected in the near term. Such a situation could arise as the Cuban economy displayed signs of sustainable growth. Global perceptions of political and economic risk would be replaced by estimates of expected recovery. The sequence of relevant events is, ordered E1-E2-E3-E4-E5-E6. Table 6A lists the prior probability of each hypothesis, and the associated conditional probabilities.

j	P(H _j)	P(E1 H _j)	P(E2 E1&H _j)	P(E3 E2..H _j)	P(E4 E3..H _j)	P(E5 E4..H _j)	P(E6 E5..H _j)
1	.02	.05	.35	.70	.10	.20	.25
2	.65	.45	.55	.80	.65	.30	.35
3	.15	.65	.75	.90	.85	.40	.45

Table 6A. Assigned Probabilities for Scenario VI

The generalized trends of the Cuban economy subsequent to the given sequence of relevant events for Scenario VI are depicted in Figure 6.

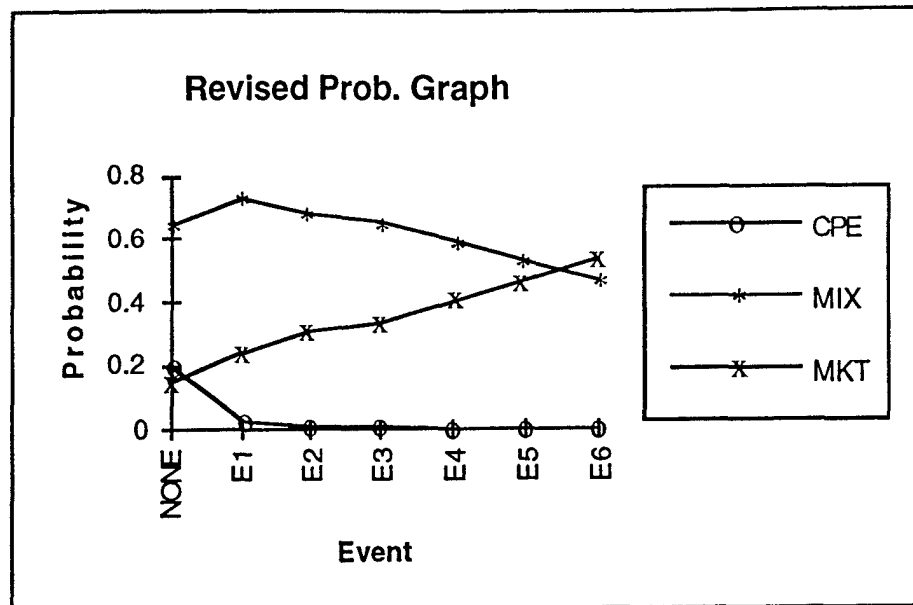


Figure 6. Revised Probability Graph for Scenario VI

The revised probabilities associated with the occurrence of each relevant event appear in Table 6B.

Event	P(CPE)	P(MIX)	P(MKT)
NONE	.200	.650	.150
E1	.025	.731	.244
E2	.015	.677	.308
E3	.012	.653	.334
E4	.002	.598	.400
E5	.001	.528	.471
E6	.001	.465	.534

Table 6B. Revised Probabilities for Scenario VI

Under the hypothetical conditions of Scenario VI: P(CPE) decreased by 99.6%; P(MIX) decreased by 28.4%; and P(MKT) increased by 255.7%.

7. Scenario VII-- An Economic Lifeline

Scenario VII considers the same pretense as Scenario VI, but instead assumes the events occur in reverse order. This scenario represents a concerted effort by the international financial community

and other nations and organizations to actively perpetuate the economic recovery of Cuba. In essence, an economic lifeline would be thrown to the Castro regime. The likelihood of such a coordinated effort prior to any major economic reforms within Cuba is low. The sequence of relevant events is ordered E6-E5-E4-E3-E2-E1. Table 7A lists the prior probability of each hypothesis, and the conditional probabilities associated with the sequence of events.

j	$P(H_j)$	$P(E6 H_j)$	$P(E5 E6 \& H_j)$	$P(E4 E5 \& H_j)$	$P(E3 E4 \& H_j)$	$P(E2 E3 \& H_j)$	$P(E1 E2 \& H_j)$
1	.20	.10	.25	.15	.70	.65	.60
2	.65	.20	.35	.55	.80	.75	.70
3	.15	.30	.45	.65	.90	.85	.80

Table 7A. Assigned Probabilities for Scenario VII

The generalized trends of the Cuban economy subsequent to the given sequence of relevant events for Scenario VII are depicted in Figure 7.

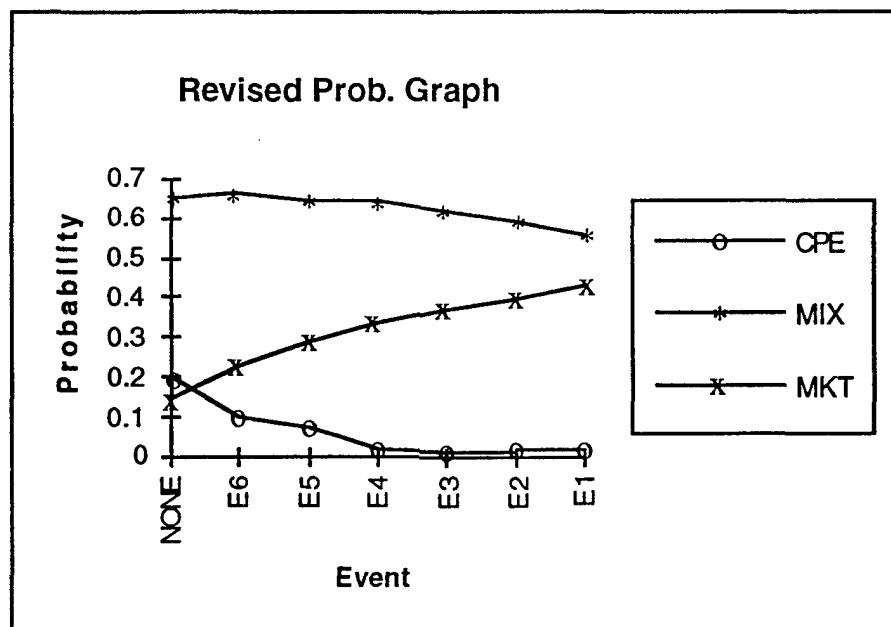


Figure 7. Revised Probability Graph for Scenario VII

The revised probabilities associated with the occurrence of each relevant event appear in Table 7B.

Event	P(CPE)	P(MIX)	P(MKT)
NONE	.200	.650	.150
E6	.103	.667	.231
E5	.071	.643	.286
E4	.019	.643	.338
E3	.016	.618	.366
E2	.013	.590	.396
E1	.011	.560	.429

Table 7B. Revised Probabilities for Scenario VII

Under the hypothetical conditions of Scenario VI: P(CPE) decreased by 94.5%; P(MIX) decreased by 13.8%; and P(MKT) increased by 186%. Before interpreting the scenario forecasts and formulating any conclusions, the probability assessments require a sensitivity analysis.

D. SENSITIVITY ANALYSIS

Sensitivity analysis is used to investigate the extent to which the revised probability of a hypothesis is influenced by any particular conditional probability. The sensitivity of a forecast to any assigned probability can be determined by varying the probability of interest, recalculating the revised probabilities, comparing these values to the original set of probabilities, and evaluating any significant differences that result. Considerable variance between the two sets of revised probabilities would require additional justification, analysis or information to ascertain the optimum value for the conditional probability in question. [Ref. 5: pp. 99-102]

1. The Foreign Exchange Earnings Under a CPE

In each of the scenarios discussed previously, the foreign exchange earning potential of a centrally planned economy was assessed to be significantly lower than that of a mixed or predominantly market economy. To demonstrate the sensitivity of a forecast to the earning potential of a CPE, a value higher than conditionally warranted is used to calculate a new set of revised probabilities. Consider Scenario I with the condition that the occurrence of Cuban foreign exchange earnings exceeding \$4 billion is, by contrast, most probable under a CPE. How is the forecast of Scenario I affected if all other conditional probabilities are unchanged? Listed in Table 8A are the assigned prior, and conditional probabilities, with the value for $P(E_1|H_1)$ appearing in **bold italics**.

j	$P(H_j)$	$P(E_1 H_j)$	$P(E_2 E_1 \& H_j)$	$P(E_3 E_2 \& E_1 \& H_j)$	$P(E_4 E_3 \& E_2 \& E_1 \& H_j)$	Rev. Prob. of H_j
1	.20	.85	.35	.70	.10	.0290
2	.65	.45	.55	.80	.65	.5819
3	.15	.65	.75	.90	.85	.3891

Table 8A. Probabilities for Sensitivity Analysis of $P(E_1|H_1)$

The revised probabilities associated with the occurrence of each relevant event have been recalculated and appear below in Table 8B.

Event	P(CPE)	P(MIX)	P(MKT)
NONE	.200	.650	.150
E1	.304	.522	.174
E2	.203	.548	.249
E3	.176	.545	.279
E4	.029	.581	.389

Table 8B. Revised Probabilities for $P(E_1|H_1) = .85$

The sensitivity of the Scenario I forecast to the conditional probability, $P(E_1|H_1) = .85$, is evident upon examining the revised probabilities of a CPE in Table 8B up to the occurrence of Event 3 and comparing them with corresponding values for $P(CPE)$ listed in Table 1A. With the condition that $P(E_1|H_1) = .85$, $P(CPE)$ decreases by only 12% after Event 3 has occurred, compared to a decrease of 93.8% calculated for Scenario I. The revised generalized trends of the Cuban economy subsequent to the given sequence of relevant events for Scenario I with $P(E_1|H_1) = .85$ are depicted in Figure 8.

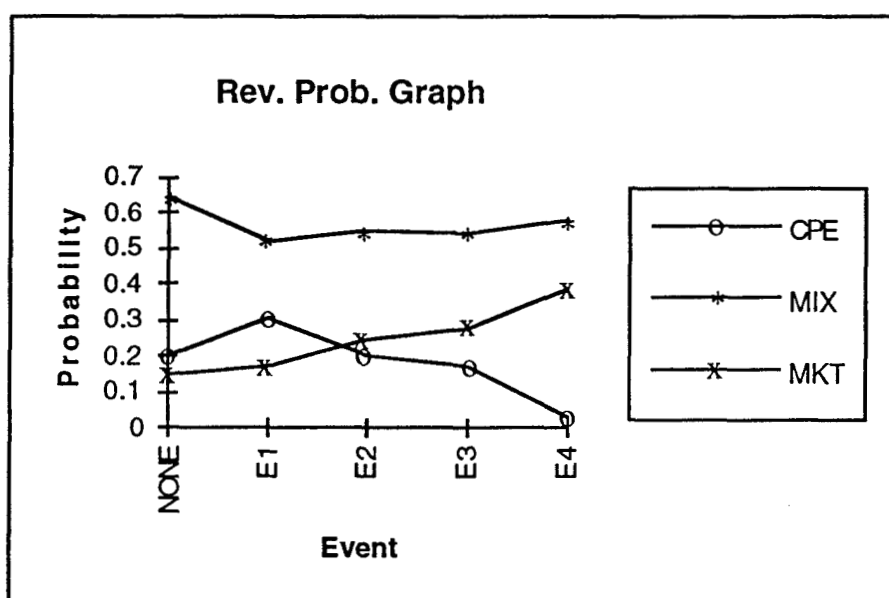


Figure 8. Revised Probability Graph for Scenario I with $P(E_1|H_1) = .85$

The current economic situation in Cuba precludes the justification for assigning the occurrence of a Cuban CPE earning foreign exchange in excess of \$4 billion a high probability. In fact it seems Castro himself has accepted this concession. Despite the sensitivity at high values of $P(E_1|H_1)$, an assigned probability ranging from .05-.65 will not significantly influence a scenario forecast.

2. Political Control and a CPE

The sensitivity of a forecast to the conditional probability of political control, $P(E3|H1)$, is analyzed similar to the case of $P(E1|H1)$. The ability of the Cuban government to maintain political control under a centrally planned economy is now assessed to be higher than under a mixed or predominantly market economy. This condition alone is sufficient to influence $P(MKT)$, but when combined with an increased conditional probability for $P(E1|H1)$ it significantly affects $P(CPE)$ as well. The previously assigned probabilities of Scenario III are chosen for this example, and a new set of revised probabilities calculated. Table 9A lists the prior, conditional and revised probabilities, with the amended values for $P(E3|H1)$, $P(E3|H3)$ and $P(E1|E4 \& E3 \& H1)$ appearing in **bold italics**.

j	$P(H_j)$	$P(E3 H_j)$	$P(E4 E3 \& H_j)$	$P(E1 E4 \& E3 \& H_j)$	$P(E2 E1 \& E4 \& E3 \& H_j)$	Rev. Prob. of H_j
1	.20	.80	.20	.85	.25	.144
2	.65	.60	.40	.45	.40	.594
3	.15	.40	.75	.55	.50	.262

Table 9A. Probabilities for Sensitivity Analysis of $P(E3|H1)$ and $P(E1|H1)$

As before, the revised probabilities associated with the occurrence of each event have been recalculated and are listed in Table 9B.

Event	$P(CPE)$	$P(MIX)$	$P(MKT)$
NONE	.200	.650	.150
E3	.262	.639	.098
E4	.137	.669	.193
E1	.223	.574	.203
E2	.144	.594	.262

Table 9B. Revised Probabilities for
 $P(E3|H1) = .80$, $P(E3|H3) = .40$ and $P(E1|E4 \& E3 \& H1) = .85$

The sensitivity of the Scenario III forecast to $P(E3|H1)$ and $P(E3|H3)$, given a high value for $P(E1|H1)$, is determined by contrasting the values for $P(MKT)$ and $P(CPE)$ listed in Table 3A with the new set of revised probabilities. Under the above conditions, $P(MKT)$ increases by 74.7%, and $P(CPE)$ decreases by only 28% after the sequence of relevant events has occurred, this compared to a $P(MKT)$ increase of 207% and a $P(CPE)$ decrease of 91% calculated for Scenario III. The revised generalized trends of the Cuban economy subsequent to the given sequence of relevant events for Scenario III with $P(E3|H1) = .80$, $P(E3|H3) = .40$ and $P(E1|E4\&E3\&H1) = .85$ are depicted in Figure 9.

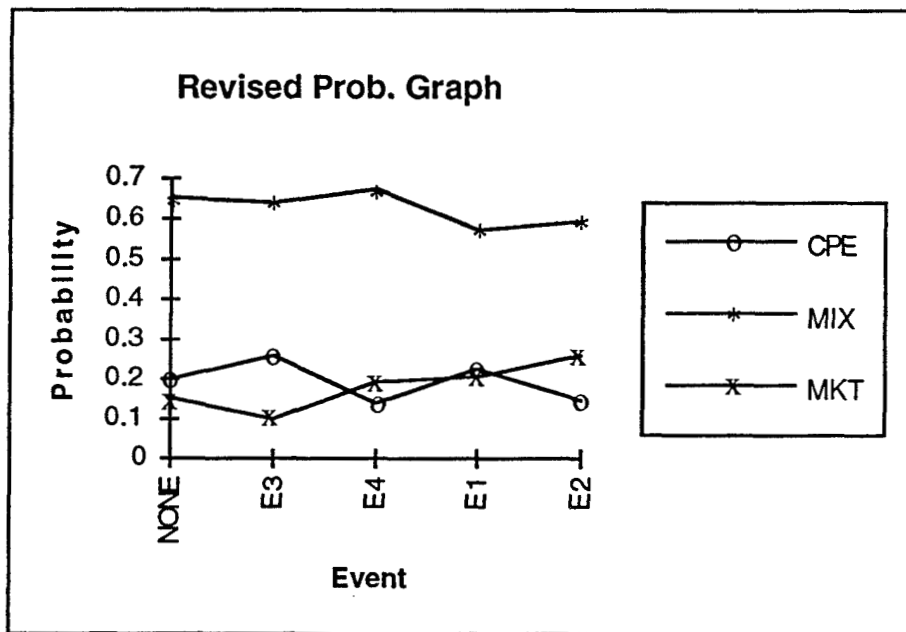


Figure 9. Revised Graph for Sensitivity Analysis of $P(E3|H1)$ and $P(E1|H1)$

The Cuban state security apparatus poses a portentous force to any civil opposition. However, as the economic crisis worsens increased repression of civil unrest will undoubtedly reach a threshold beyond which its effectiveness will be minimal. Furthermore, it is

unlikely that a CPE will facilitate the Castro regime in maintaining political control as it is defined in Event 3. Arguably in the case of Cuba, definite political control is seen to be jeopardized by the adoption of free market mechanisms. A predominantly market economy operating under lesser economic controls could intensify a concurrent appetite of organized opposition for more political freedoms. Ascribing high values to $P(E_3|H_1)$ in the near term cannot be readily justified, and the sensitivity of a scenario forecast assigned such a conditional probability exceeding 0.60 will prove significant.

3. The Foreign Exchange Earnings Under a Market Economy

Each of the scenarios previously examined assesses the foreign exchange earning potential of a predominantly market economy (MKT) to be significantly higher than either a mixed economy or CPE. Consider Scenario I with the condition that Cuban foreign exchange earnings exceeding \$4 billion is considerably less probable under a MKT. In this case, the forecast sensitivity to $P(E_1|H_3)$, is determined by using a lower conditional probability. Listed in Table 10A are the assigned prior, conditional and revised probabilities, with the value for $P(E_1|H_3)$ in ***bold italics***.

j	$P(H_j)$	$P(E_1 H_j)$	$P(E_2 E_1 \& H_j)$	$P(E_3 E_2 \& E_1 \& H_j)$	$P(E_4 E_3 \& E_2 \& E_1 \& H_j)$	Rev. Prob. of H_j
1	.20	.05	.35	.70	.10	.003
2	.65	.45	.55	.80	.65	.904
3	.15	<i>.10</i>	.75	.90	.85	.093

Table 10A. Assigned Probabilities with $P(E_1|H_3) = .10$

The revised probabilities associated with the occurrence of each event are subsequently recalculated and appear in Table 10B.

Event	P(CPE)	P(MIX)	P(MKT)
NONE	.200	.650	.150
E1	.031	.921	.047
E2	.020	.916	.064
E3	.017	.911	.072
E4	.003	.904	.093

Table 10B. Revised Probabilities for $P(E1|H3) = .10$

The sensitivity of the Scenario I forecast to a low value of $P(E1|H3)$, is analyzed upon comparing the values for $P(MKT)$ and $P(CPE)$ listed in Table 1B with the new set of revised probabilities in Table 10B. Under the amended initial condition, $P(MKT)$ decreases by 38%, and $P(MIX)$ increases by 39.1% after the sequence of relevant events has occurred, this contrasted with a $P(MKT)$ increase of 167% and a $P(MIX)$ decrease of 8% previously calculated for Scenario I. The generalized trends of the Cuban economy subsequent to the given sequence of relevant events for Scenario I with $P(E1|H3) = .10$ are depicted in Figure 10.

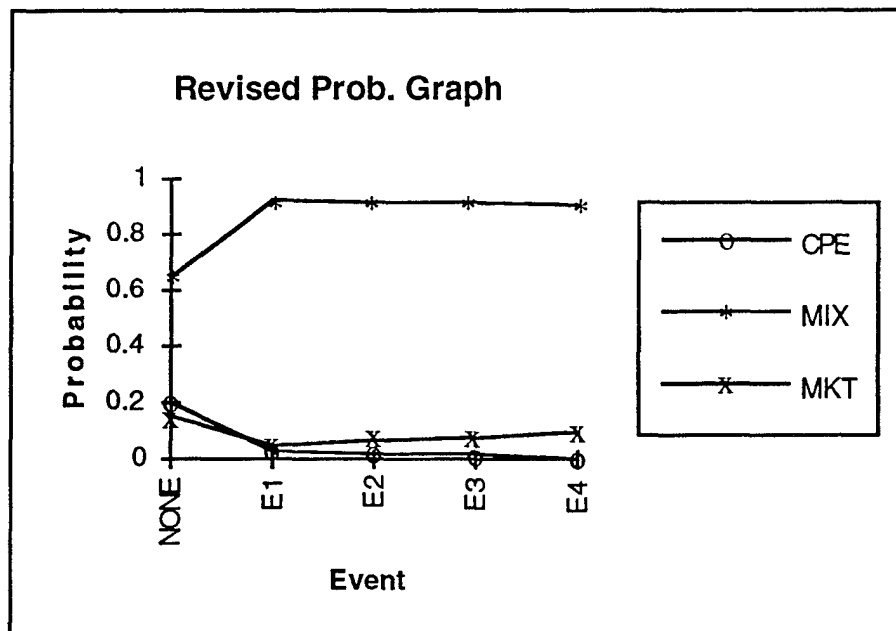


Figure 10. Revised Probability Graph for Scenario I with $P(E1|H3) = .10$

Assigning $P(E_1|H_3)$ a low value relative to $P(E_1|H_1)$ and $P(E_1|H_2)$ does not accurately reflect the foreign exchange earning potential of a predominantly market economy. Associating a relatively higher conditional probability to $P(E_1|H_3)$ is justified, given the historic inefficiencies of Cuba's CPE and the limited number of autonomous export earning enterprises expected to operate in a mixed Cuban economy. To overcome forecast sensitivity at low values of $P(E_1|H_3)$, its assigned conditional probability should be greater than 0.55 or the difference between $P(E_1|H_3)$ and both $P(E_1|H_2)$ and $P(E_1|H_1)$ at least 0.20.

4. Pessimistic and Optimistic Probability Judgments

Sensitivity analysis may also confirm if a scenario forecast is influenced by overly optimistic or pessimistic probability judgments of a particular event. Consider Scenario I with the condition that Cuban foreign exchange earnings exceeding \$4 billion are considerably less probable under each of the hypotheses: CPE, MIX, and MKT. In this example lower assigned values of $P(E_1|H_j)$, $j = 1,2,3$; define a pessimistic assessment of Event 1. Table 11A list the assigned prior, conditional and revised probabilities, with the affected values for $P(E_1|H_j)$ shown in ***bold italics***.

j	$P(H_j)$	$P(E_1 H_j)$	$P(E_2 E_1 \& H_j)$	$P(E_3 E_2 \& E_1 \& H_j)$	$P(E_4 E_3 \& E_2 \& E_1 \& H_j)$	Rev. Prob. of H_j
1	.20	<i>.05</i>	.35	.70	.10	.008
2	.65	<i>.10</i>	.55	.80	.65	.575
3	.15	<i>.15</i>	.75	.90	.85	.417

Table 11A. Assigned Probabilities for Pessimistic Assessment of E_1

The revised probabilities associated with the occurrence of each relevant event are subsequently recalculated and appear in Table 11B.

Event	P(CPE)	P(MIX)	P(MKT)
NONE	.200	.650	.150
E1	.102	.667	.231
E2	.062	.637	.301
E3	.053	.618	.328
E4	.008	.575	.417

Table 11B. Revised Probabilities for Pessimistic Assessment of E1

For the sake of argument the original conditional probabilities listed in Table 1A are considered an optimistic assessment of Event 1. Under the optimistic condition, P(CPE) decreased 99%, P(MIX) decreased 8% and P(MKT) increased by 167%, after the complete sequence of events had occurred. The revised forecast, incorporating the pessimistic probabilities, resulted in P(CPE) decreasing 96%, P(MIX) decreasing 11.5% and P(MKT) increasing by 178%. The generalized trends of the Cuban economy subsequent to the sequence of events for Scenario I and a pessimistic assessment of Event 1 appears in Figure 11.

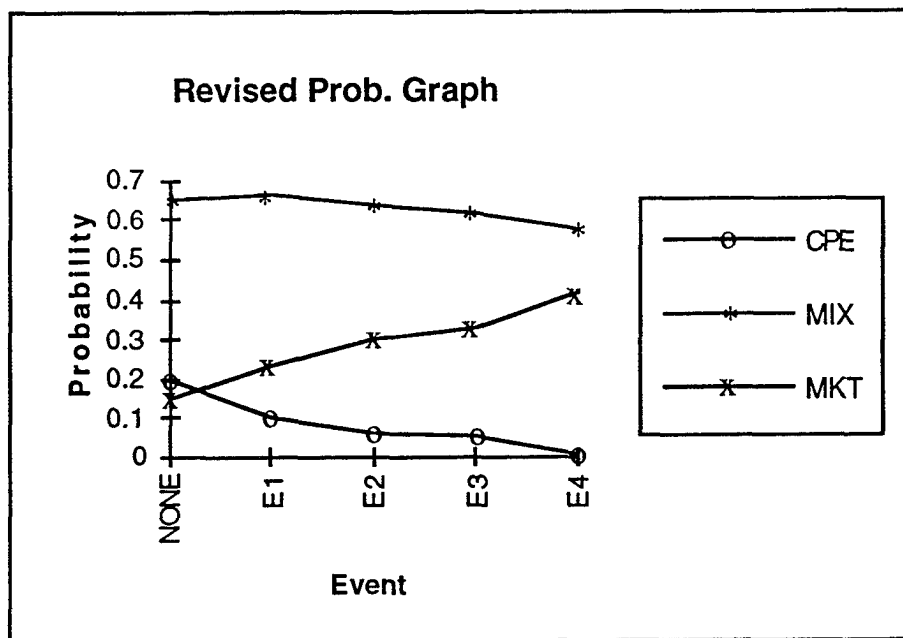


Figure 11. Revised Probability Graph for Pessimistic Assessment of E1

As this example illustrates, sensitivity analysis can be extended to establish the sensitivity of a forecast to the "pessimistic/optimistic" assessment of a particular event. All assigned conditional probabilities specific to the event must be re-evaluated before proceeding with any analysis of the revised probabilities. For Scenario I, a pessimistic assessment of E1 results in a revised probability over four times higher than calculated in the optimistic case for P(CPE) after each event occurs. The revised probabilities calculated after the occurrence of the final event, however, do not appear significantly influenced by the quantification of a pessimistic assessment.

V. FORECAST RESULTS AND CONCLUSIONS

A. FORECAST RESULTS

The forecast results of Scenario I reveal a sharp increase (62.7%) in P(MKT) coinciding with a sharper decline (87.5%) in P(CPE) after Cuban foreign exchange earnings exceed \$4 billion. As subsequent events occur both P(MKT) and P(CPE) continue to increase and decrease respectively, but at a much less pronounced rate. The differences between the systemic attributes of a CPE and MKT directly affect their capacity to achieve the necessary conditions for Event 1. It is this disparity that accounts for the dramatic divergence between P(MKT) and P(CPE) in Scenario I. The probability associated with a mixed economy, P(MIX), exhibits a steady decline of only 3%-8% after a modest initial increase of 12.4%. Overall, the probabilistic estimate of Cuba's economic direction under the conditions for Scenario I suggests a steady convergence towards a 60%-40% split between P(MIX) and P(MKT) after the sequence of relevant events occurs.

The forecast results of Scenario II essentially parallel those of Scenario I, with P(MKT) demonstrating a slightly lower rate of increase. The most recent political and economic events in Cuba more closely resemble the sequence assumed under Scenario II, however, the revised probabilities calculated for both forecasts are approximately the same.

The forecast results of Scenario III reveal a large displacement for both P(MKT) and P(CPE) after the occurrence of Event 4. The revised probability for a MKT increases by 69.4% while the revised probability of a CPE decreases by 55.1%. The probability associated with a MIX exhibits a steady decline of 4%-10% after an initial increase of only 1.7%. The facility of implementing economic reforms resulting in less centralization under a MKT versus a CPE explains the divergence. Such reforms represent a compromise by the Castro regime to counter increased civil unrest and preserve political control. Of the seven scenarios analyzed, the forecast results of Scenario III offer the closest approximation to a 50%-50% assessment of P(MKT) versus P(MIX).

The forecast results of Scenario IV are similar to those of Scenario III, displaying the most significant probability shift after the occurrence of Event 4. In this case, however, marked convergence is evident between P(MKT) and P(MIX). The revised probability for a MKT increases by 45.2% while the revised probability of a MIX decreases by 17.0%, closing the previous gap between the two by 57.2%. The revised probability associated with a CPE exhibits an initial decrease of 94.5%, reflecting its inability to meet import substitution levels descriptive of Event 2. The forecast results of Scenario IV approximate those of Scenario III since the scarcity of basic commodities necessary for daily survival in Cuba could spark the civil disobedience and unrest examined under Scenario III.

The forecast results of Scenario V consider equal probability of the three hypotheses: CPE, MIX, MKT. The revised probabilities

immediately diverge from one another with P(MIX) experiencing the least change after the sequence of events has occurred, ultimately resulting in an approximate 74%-26% split between P(MKT) and P(MIX). The dominance of P(MKT) after the sequence of events has occurred is not unexpected since the conditions most favorable to each event is optimum under a predominantly market economy.

The forecast results of Scenario VI postulate Cuba's economic direction in the medium term. The revised probabilities portray an extension of the converging economic trends examined under Scenario I. Importantly, the revised probabilities of P(MKT) and P(MIX) cross and separate after Event 5, but before the occurrence of Event 6. It is at this point that P(MKT) overtakes P(MIX) suggesting the likelihood of Cuba integrating into the global economy as a predominantly market economy given Events 1 through 6 have transpired.

Similar to the analogy drawn between Scenarios I and II, the forecast results of Scenario VII parallel those of Scenario VI. The revised probabilities of Scenario VII depict steady convergence between P(MKT) and P(MIX). The probability of a mixed economy, however, remains approximately 13 percentage points higher than the probability of a predominantly market economy after the sequence of events has occurred. Upon initial observation, the forecast results of Scenarios VI and VII lend some support to principals advocating the continued imposition of the U.S. trade embargo against Cuba as a means to bring about a free market economy there. The inferences will not be pursued and are beyond the scope of this study.

B. CUBA'S ECONOMIC DIRECTION

The conditions guiding Cuba's economic direction are dominated by the Cuban socialist experience, the supremacy of Fidel Castro, and the stark isolation which confronts the Cuban economy. The course taken by the Cuban economy in the near term is conditionally dependent upon reform measures directed at preserving the two former conditions and resolving the third. It is this conditional dependence that lends itself to a Bayesian formulation of possible scenarios and a forecast indicative of economic direction. The examination of each scenario forecast reveals probabilistic outcomes subsequent to a specific sequence of events deemed relevant to Cuba's economic future. The juxtaposition of the event order represents varying combinations of both economic and political priorities critically challenging the Castro regime. Whether taken individually or compositely the scenario forecasts suggest either a mixed economy or a predominantly market economy as the most probable path given the economic challenges ahead. The perpetuation or resurrection of a centrally planned economy by the Castro regime does not seem practical or probable if economic rationality prevails.

C. CUBA'S ECONOMIC RECOVERY

As postulated, the scenario forecasts presented in Chapter IV do not explicitly determine the probability of Cuba's economic recovery in absolute terms. Inferred from the Bayesian data analysis is the probabilistic response of three hypothetical outcomes to a set of conditions that may occur along a path to economic recovery. The construction of a Bayesian forecast requires the subjective definition of

relevant conditional probabilities, which determine the revised probability of an outcome given that an event or sequence of events has already happened. As defined, Events 1 through 6 establish a conceivable set of occurrences marking a path for Cuba's economic recovery. The prescribed sequence of events generating each scenario is a simple permutation of the event set, whose intent is not to exclusively characterize all possible paths, but to allow for analytical balance. The scenario forecasts calculate the revised probabilities of each possible outcome (CPE, MIX, MKT), and therefore can be interpreted as an updated estimate of outcome consequential to Cuba's incremental progress towards favorable economic conditions and recovery.

The economic recovery of Cuba is contingent upon more than the occurrence of Events 1 through 6 in any particular order. Other target variables such as measured economic growth rates, and monetary and fiscal policy reforms are also principal factors to consider. A lack of information, however, will complicate the translation of these variables into relevant events and make the subjective probability assignments increasingly more difficult. For example, there may be a time lag between economic successes and the actual measured economic growth where essential data has yet to be compiled. Cuba's economic recovery presents a slightly different problem from estimating the future direction of the Cuban economy. Resolution of either conundrum reveals their conditional dependence and requires caution to preclude or identify events prejudicial to a particular outcome or economic strategy. Events 1 through 6 are

justifiable since a different sequence of events less skewed towards market reforms, does not accurately portray the events, initiatives and debates currently taking place in Cuba. Deduced from the scenario forecasts, Cuba may indeed muddle through with a mixed economy, but to advance the conditions most favorable for economic recovery will warrant a predominantly market economy.

D. APPLICABILITY OF BAYESIAN FORECASTING

Bayesian forecasting proves to be an acceptable method by which to explicitly determine the probabilistic outcomes of the Cuban economy given the occurrence of a single event or a sequence of relevant events. The strength of the analysis lies in the flexibility afforded to the forecaster to readjust assigned probabilities as the political and economic currents shift in Cuba. To incorporate the postulations of a different sequence of relevant events or additional events, congruent with the dynamics of the Cuban crisis, the forecaster need only formalize the associated conditional probabilities. The forecast results, derived from the deductive vice inductive judgments of the information or evidence available at the time, in essence assign a degree of precision to the uncertainty of Cuba's economic future. A sensitivity analysis finalizes the Bayesian forecast of the Cuban economy identifying subjective conditional probabilities that will considerably affect the scenario forecasts should their values vary significantly. The sensitivity analysis also provides the means by which to compare Cuba's pessimistic, optimistic, and realistic case scenarios.

A Bayesian forecast of the Cuban economy is not without its shortcomings. Essential to the analysis is a clear definition of the relevant events whose translations, from key target variables, risk idiosyncratic or situational bias. Such prejudice may be unavoidable if complete information is unavailable or existing information suspect. In addition, to expand the possible Cuban economic hypotheses beyond 3-5 mutually exclusive hybrid classifications would require extensive probability computations, most likely aided by computer algorithm.

APPENDIX A. INTRODUCTION TO BAYES' THEOREM

The event-composition approach to solving probability problems is sometimes facilitated by viewing a sample space S as a union of mutually exclusive subsets or hypotheses. That is, if we assume that $S = H_1 \cup H_2 \cup \dots \cup H_k$, where $H_i \cap H_j = \{\}$ for $i \neq j$. Then any subset E of S can be written as

$$\begin{aligned} E &= E \cap S = E \cap (H_1 \cup H_2 \cup \dots \cup H_k) \\ &= (E \cap H_1) \cup (E \cap H_2) \cup \dots \cup (E \cap H_k) \end{aligned}$$

We then observe that

$$\begin{aligned} P(E) &= P(E \cap H_1) + P(E \cap H_2) + \dots + P(E \cap H_k) \\ &= P(H_1)P(E|H_1) + P(H_2)P(E|H_2) + \dots + P(H_k)P(E|H_k) \\ &= \sum_{i=1}^k P(H_i)P(E|H_i) \end{aligned}$$

A conditional probability of the form $P(H_j|E)$ can then be evaluated as:

$$P(H_j|E) = \frac{P(E \cap H_j)}{P(E)} = \frac{P(H_j)P(E|H_j)}{\sum_{i=1}^k P(H_i)P(E|H_i)}$$

This formula for conditional probability is known as Bayes' theorem.

A general formula for the revised probability of any hypothesis H_j , when there are "n" events and "m" hypotheses is given by:

$$\begin{aligned}
 &P(H_j | E_1 \& E_2 \& \dots \& E_n) = \\
 &P(H_j) \times P(E_1 | H_j) \times P(E_2 | H_j \& E_1) \dots P(E_n | H_j \& E_1 \& E_2 \& \dots \& E_{n-1}) \\
 &\hline
 &P(H_1) \times P(E_1 | H_1) \times P(E_2 | H_1 \& E_1) \dots P(E_n | H_1 \& E_1 \& E_2 \& \dots \& E_{n-1}) \\
 &+ P(H_2) \times P(E_1 | H_2) \times P(E_2 | H_2 \& E_1) \dots P(E_n | H_2 \& E_1 \& E_2 \& \dots \& E_{n-1}) \\
 &\cdot \\
 &\cdot \\
 &\cdot \\
 &+ P(H_m) \times P(E_1 | H_m) \times P(E_2 | H_m \& E_1) \dots P(E_n | H_m \& E_1 \& E_2 \& \dots \& E_{n-1}).
 \end{aligned}$$

APPENDIX B. AN EXAMPLE OF HIERARCHICAL INFERENCE

The following is an example of how hierarchical inference is used to calculate the assigned probability of a relevant event.

Problem: How to incorporate the available data on Cuban nickel production and world market prices into the calculation of the assigned probability of Cuban foreign exchange earnings exceeding \$4 billion (Event 1) for a predominantly market economy (MKT), under the conditions of Scenario VII .

Solution: The sequence of events for Scenario VII occur in the following order: E6-E5-E4-E3-E2-E1, and when combined with the hypothesis of a market economy represent the most favorable conditions for Cuban nickel production. The data presented in Table B1 is extracted from the CIA Trade Statistics for Cuba 1993.

Row		<u>1990</u>	<u>1991</u>	<u>Average (90-91)</u>
1	Total Exports (in \$ bn)	4.910	3.550	4.230
2	Sugar	3.690	2.670	3.180
3	Tourism	0.125	0.144	0.135
4	Nickel	0.362	0.272	0.317
5	Tobacco	0.095	0.100	0.975
6	Citrus	0.150	0.100	0.125
		-----	-----	-----
	Total of Rows 2-6	4.422	3.286	3.855
	% of Row 1	0.90	0.92	0.91

Table B1. Major Export Earnings 1990-1991

From the above data it is assumed that export earnings from sugar, tourism, nickel, tobacco, and citrus account for 91 percent of the

total. Event 1 stipulates that foreign exchange earnings exceed \$4 billion, which implies that: $(\$4 \text{ bn}) \times (.91) = \3.64 bn must be earned by Cuba's major export oriented sectors listed in Table B1.

Event 1 is conditionally dependent on sub-events derived from the 1990-91 average values with slight, justifiable modifications:

1. sub-event e1: Sugar export earnings > \$2.885 bn
(less than average due to the recent decline in sugar harvests)
2. sub-event e2: Tourism earnings > \$ 0.250 bn
(more than average due to the recent increases in the sector)
3. sub-event e3: Nickel export earnings > \$0.285 bn
(less than average due to lost CEMA markets)
4. sub-event e4: Tobacco export earnings > \$0.095 bn
5. sub-event e5: Citrus export earnings > \$0.125 bn

For the purposes of simplicity sub-event e3 is itself assumed to be conditionally dependent upon two events, e1 and e2 :

1. e1 : Cuban nickel production > 45 thousand metric tons
(this value represents a maximum estimate)
2. e2 : the world price for nickel > \$6400/metric ton

A tabular array of assigned probabilities is constructed, which includes the revised probabilities calculated using Bayes' theorem. The results are shown in Table B2, with the negation of sub-event e3 (nickel export earnings < \$0.285 bn) denoted by $\hat{e}3$.

	Prob.	P(e1)	P(e2&e1)	Rev. Prob. of H _j
e3	.30	.55	.45	.64
$\hat{e}3$.70	.20	.30	.36

Table B2. Probabilities for Sub-Event e3

From the data presented in Table B2 it is clear that the probability of Cuban nickel earnings exceeding \$0.285 bn has increased to 64% (from 30%) given that output production is in excess of 45 thousand metric tons and the world price for nickel is greater than \$6400 per metric ton. This revised probability now becomes an assigned probability which is combined with those associated with the other sub-events, and Bayes' theorem is again applied to determine the revised probability of Event 1. The results appear in Table B3, with the negation of Event 1 denoted by $\hat{E}1$.

	Prob.	$P(e1)$	$P(e2 \& e1)$	$P(e3 \& e2 \& e1)$	$P(e4 \& \dots \& e1)$	$P(e5 \& \dots \& e1)$	Rev. Prob. of H_j
E1	.15	.79	.68	.64	.57	.55	.80
$\hat{E}1$.85	.15	.50	.40	.45	.35	.20

Table B3. Probabilities for Event 1

The probability for E1 given that all the sub-events, $e1 \dots e5$, have occurred has been revised to .80 as shown above. As the final step in the hierarchical inference process, this value is incorporated into the assigned probabilities of Scenario VII. It appears as $P(E1|E2 \& \dots \& E6 \& H3)$ in the seventh column, third row of Table 7A.

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